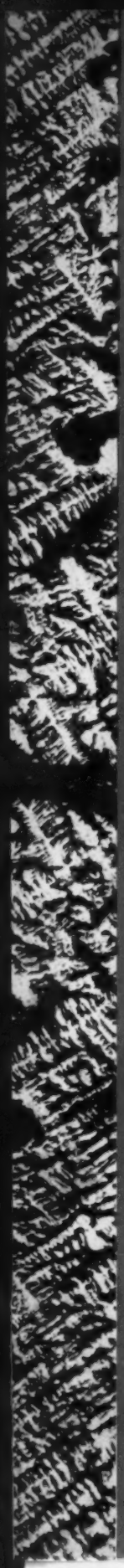

SEPTEMBER
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FOUNDRY

A PENTON PUBLICATION

Solidification and Heat Treatment

Gray Iron . . Malleable Iron . . Steel . . Brass and Bronze . . Aluminum . . Magnesium — p. 84

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Circle 554 on Page 53

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September 1959
Volume 87—Number 9

FOUNDRY
A PENTON PUBLICATION

September is back-to-school month. A number of future foundry engineers will be among the students returning to those schools co-operating in the Foundry Educational Foundation program. For a brief glimpse of the life of one of the graduate students, see Page 180.

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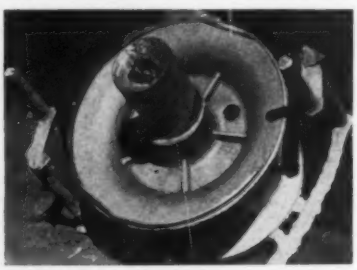
FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly and copyright 1959 by The Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

THE EDITORS' WORKSHOP

GATING AND RISERING: Next month we shall present the first of a series of articles on one of the most important phases of foundry practice—gating and risering. In its entirety the series will represent an extremely comprehensive and up-to-date treatment of the subject by 15 well known authorities.

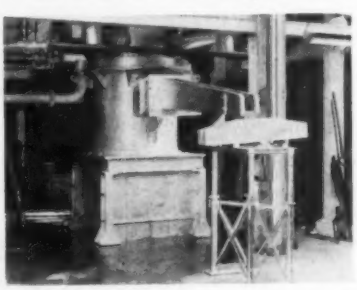
The material is being prepared



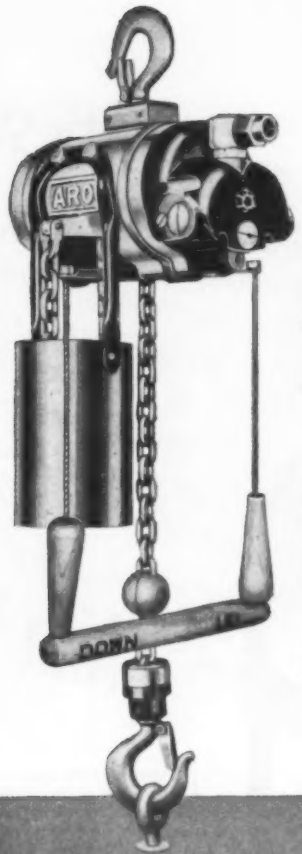
under the direction of Prof. John F. Wallace, Case Institute of Technology. He and Edward B. Evans, also of Case, are co-authors of next month's article, "Principles of Gating." In subsequent months, principles of risering and the special characteristics of various metals as they affect gating and risering will be treated.

Other articles will discuss recommended practice in this field for shell, investment, diecasting, and permanent molds.

RESEARCH: Shown below is a highly versatile cupola. The British Cast Iron Research Association, which installed it recently at Alve-



church, England, incorporated in it the most advanced design, full instrumentation, and the ability to operate under any type of working conditions. Details next month.



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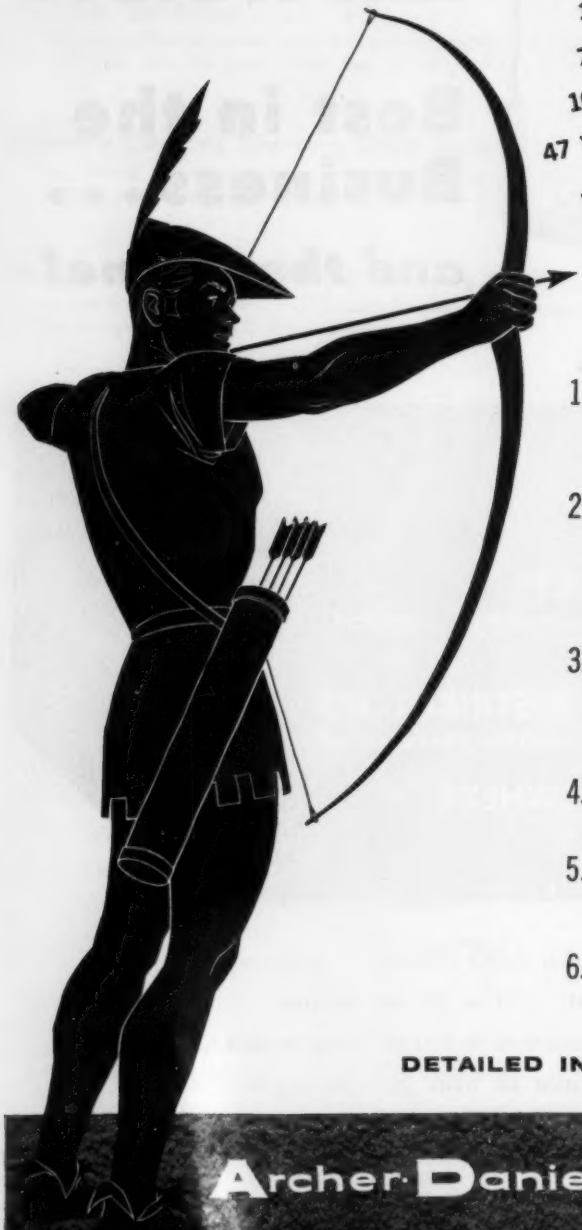

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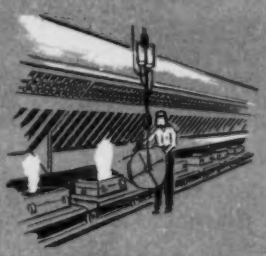

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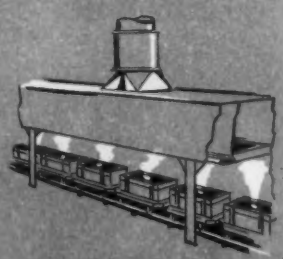
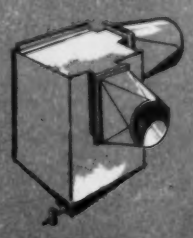


CONVEYOR HOODS



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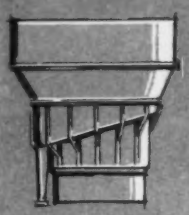

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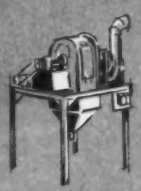

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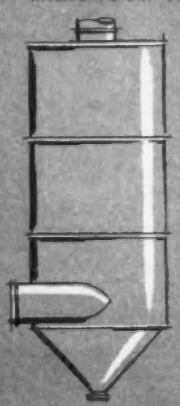

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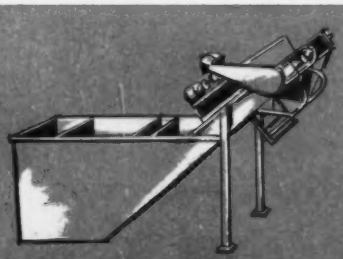

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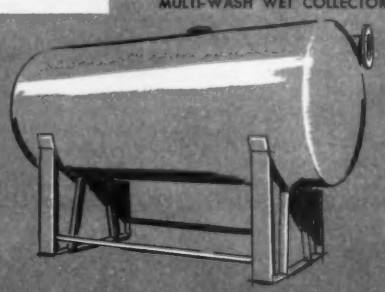

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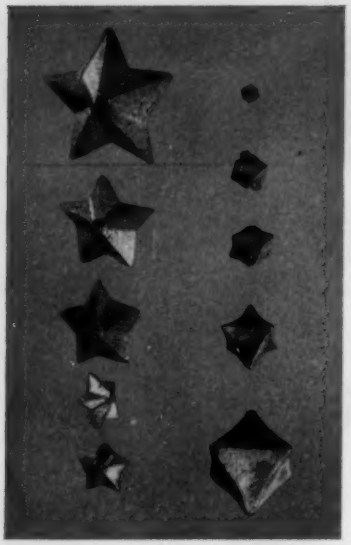

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Circle 560 on Page 53

With the Editors

HOW WE DOING?: Editors of business publications constantly are trying to determine how well the editorial material they present meets the needs of readers. They talk to readers in the field, and study closely the letters received from readers, but this does not give as broad a picture as desired.

For several years FOUNDRY editors used the services of an independent organization that sent interviewers to call on foundrymen and ask how well the editorial content was serving. The information gathered proved helpful and resulted in a number of editorial changes to improve our service.

During the last two years, we have been accumulating information on readership from Ad-Gage studies, a survey method developed by our sister publication, *Machine Design*. In these studies, copies of an issue are sent to 500 readers several weeks after the issue originally was mailed, with the request that the reader mark each page or column (editorial and advertising) which was of interest to him and return the copy. Through the generous cooperation of many readers, interesting data have been developed.

Of the regular departments, Questions and Answers and Late News usually lead in reader interest. For example, in January, February, and April, the three issues tabulated so far this year, Questions and Answers showed a 52, 57, and 61 per cent interest and Late News a 69, 50, and 57 per cent interest. Reader interest in What's New in Equipment and Supplies for those issues was 54, 51, and 48 per cent, and for the editorial it was 53, 35, and 46 per cent.

In the January issue, the leading feature article was "Quality Control Is Old Stuff in the Foundry"; in February it was "How To Make Incentive Plans Successful"; and in April "Managing a Foundry Professionally." All are general subjects having a broad appeal.

Information gathered in these surveys is studied carefully to improve editorial material constantly.

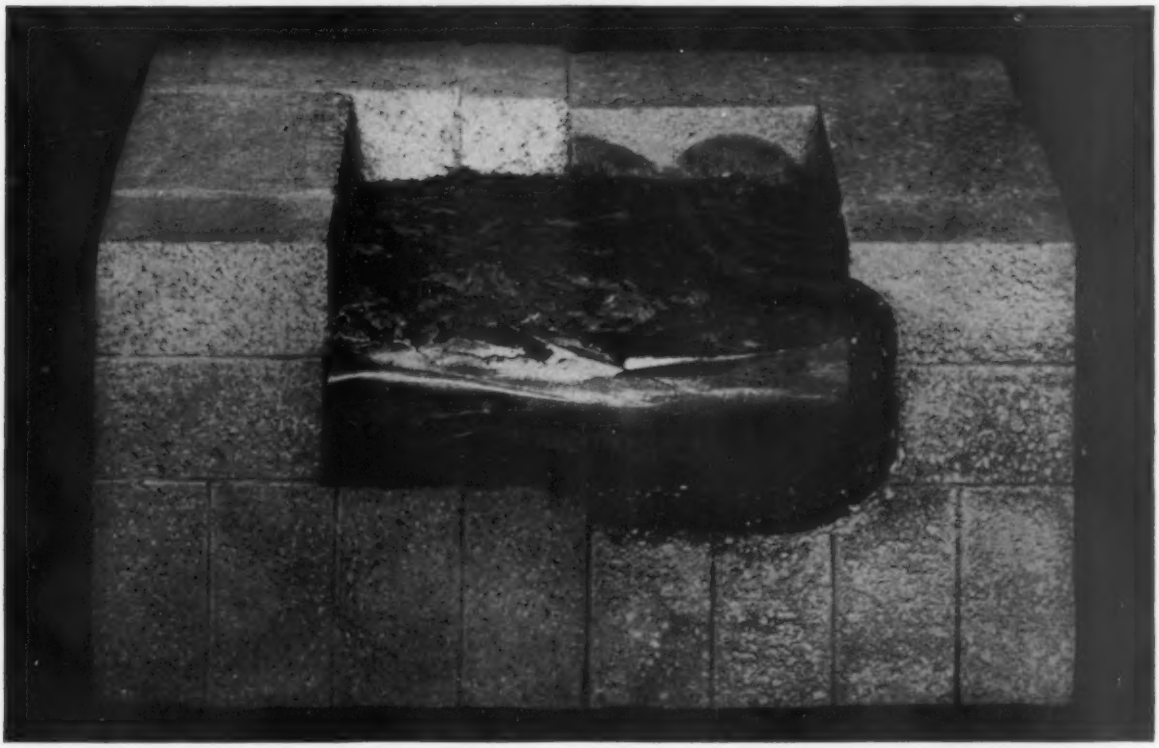
—o—

American Equipment: After reading the account of the British Foundry Exposition (Page 156, July issue), William Tait, Acme Conveyors Ltd., Walsall, Staffordshire, England, sent the accompanying photograph of that firm's display. He points out that the company showed a model of a mold conveyor of C. O. Bartlett & Snow Co., Cleveland, (foreground); a vibrating conveyor of Ajax Flexible Coupling Co., Westfield, N. Y. (background); and an air tumbler produced under license from Dust Suppression & Engineering Co., Lake Orion, Mich.

—o—

The Right Words: J. B. Nordholt, Jr., president, Webster Mfg. Co., Tiffin, Ohio, and president, Conveyor Equipment Manufacturers Association, recently told association members that "Carelessly worded statements made by busi-

CORALITE 3-59 *shows superior resistance to molten aluminum.* In this photograph of a laboratory furnace hearth used for testing aluminum melting furnace refractories, the hearth has been cut in half to show relative resistance to penetration by molten aluminum. On the left is the Harbison-Walker CORALITE 3-59 laid with CORALBOND. On the right is a normal high-alumina brick laid with a widely used air-setting bonding mortar.



Unique refractories developed by HARBISON-WALKER fulfill fast growing needs for aluminum melting furnaces

Among H-W leading refractories developed specifically for modern aluminum melting practice, CORALITE 3-59 brand is particularly worthy of consideration. The unusual combination of physical and chemical properties of this refractory, most highly commend it for the wide diversity of intensified melting conditions.

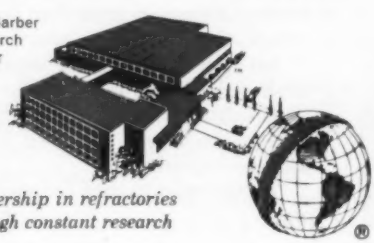
CORALITE 3-59 is a very hard burned brick containing approximately 85% alumina. It is made with a special bond (patent pending) which contributes to its remarkable strength and low permeability. Its transverse strength is three times that of strong fireclay brick. This is the significant criterion of its capacity for withstanding severe impact and abrasion.

SUPERIOR PROPERTIES OF CORALITE 3-59

- ***Resistance to*** penetration by molten metal at maximum working temperatures.
- ***Resistance to*** corrosion by aluminum alloys and various fluxes.
- ***Resistance to*** impact and abrasion accompanying charging of cold metal.
- ***Resistance to*** metal contamination resulting from chemical reaction.

CORALBOND is a phosphate bonded high-alumina mortar developed specifically for use in aluminum melting furnaces. Among numerous mortars of many compositions, CORALBOND is very outstanding in its resistance to penetration and corrosion by aluminum alloys at the furnace operating temperatures.

The Garber Research Center



Leadership in refractories through constant research

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES — GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

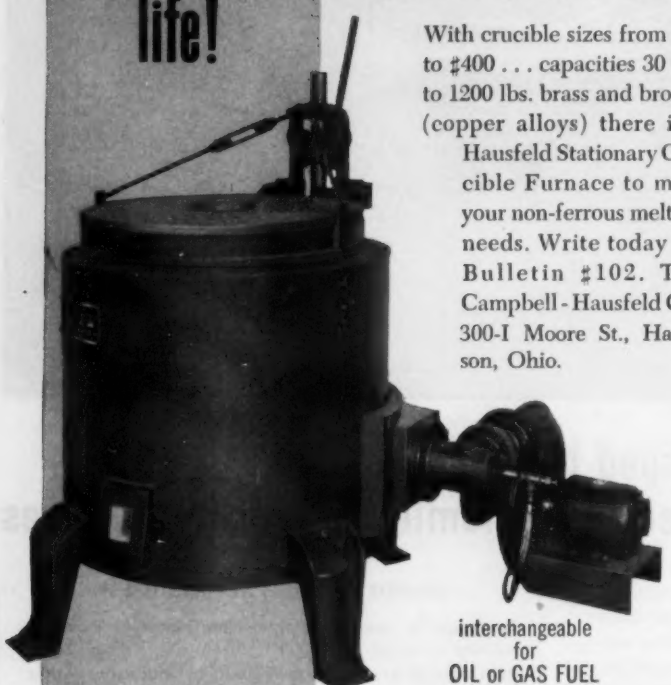
Circle 561 on Page 53

Engineered for longer crucible life!

■ In the Oil Fuel models, as shown, the special higher-pressure mechanical atomizing oil spray—a Hausfeld exclusive—produces a clear, hot flame with minimum cutting action . . . *increases* crucible and lining life.

■ Well insulated lining assures uniform heat dispersal—cuts heat loss and assures many years of fast, efficient melting of brass and bronze.

With crucible sizes from #10 to #400 . . . capacities 30 lbs. to 1200 lbs. brass and bronze (copper alloys) there is a Hausfeld Stationary Crucible Furnace to meet your non-ferrous melting needs. Write today for Bulletin #102. The Campbell-Hausfeld Co., 300-I Moore St., Harrison, Ohio.



interchangeable for OIL or GAS FUEL

Hausfeld STATIONARY CRUCIBLE FURNACES

CAMPBELL-HAUSFELD
METAL MELTING FURNACES

ness men provide ready-made mudballs to throw by anyone who wants to take a round-house swing at business."

He pointed out that casual readers and listeners are especially likely to misunderstand "gross profit," and the smart business man avoids the use of that term. He believes that extreme care must be used by business men in choosing words.

—o—

All Are Foundrymen: The Farrels have been associated with Farrel-Birmingham Co., Ansonia, Conn., since its organization well over 100

years ago. The accompanying illustration shows Franklin Farrel 3rd, president, receiving a 25-year company service pin from his father (left), Franklin Farrel Jr., who himself was an executive of the firm for 41 years prior to his retirement as chairman of the board in 1945. Furthering this lineage continuity is the fact that Franklin Farrel Jr.'s father, Franklin Farrel, was president of the heavy machinery manufacturing concern from 1869 to 1912 and, as a youth, was co-founder of the company in 1848, with his father Almon Farrel.

—o—

How You Divide It: I goofed. This column in August commented on a newspaper clipping which reported on the visit of the queen and Prince Philip to "one of the open cast iron mines" at Seven Islands, Quebec. A little fun was directed at "cast iron" mines. Now it has been called to my attention, shall we say forcibly, that the term "open cast," as used by our friends in Canada, means "Exposed to the air, like—quarry."

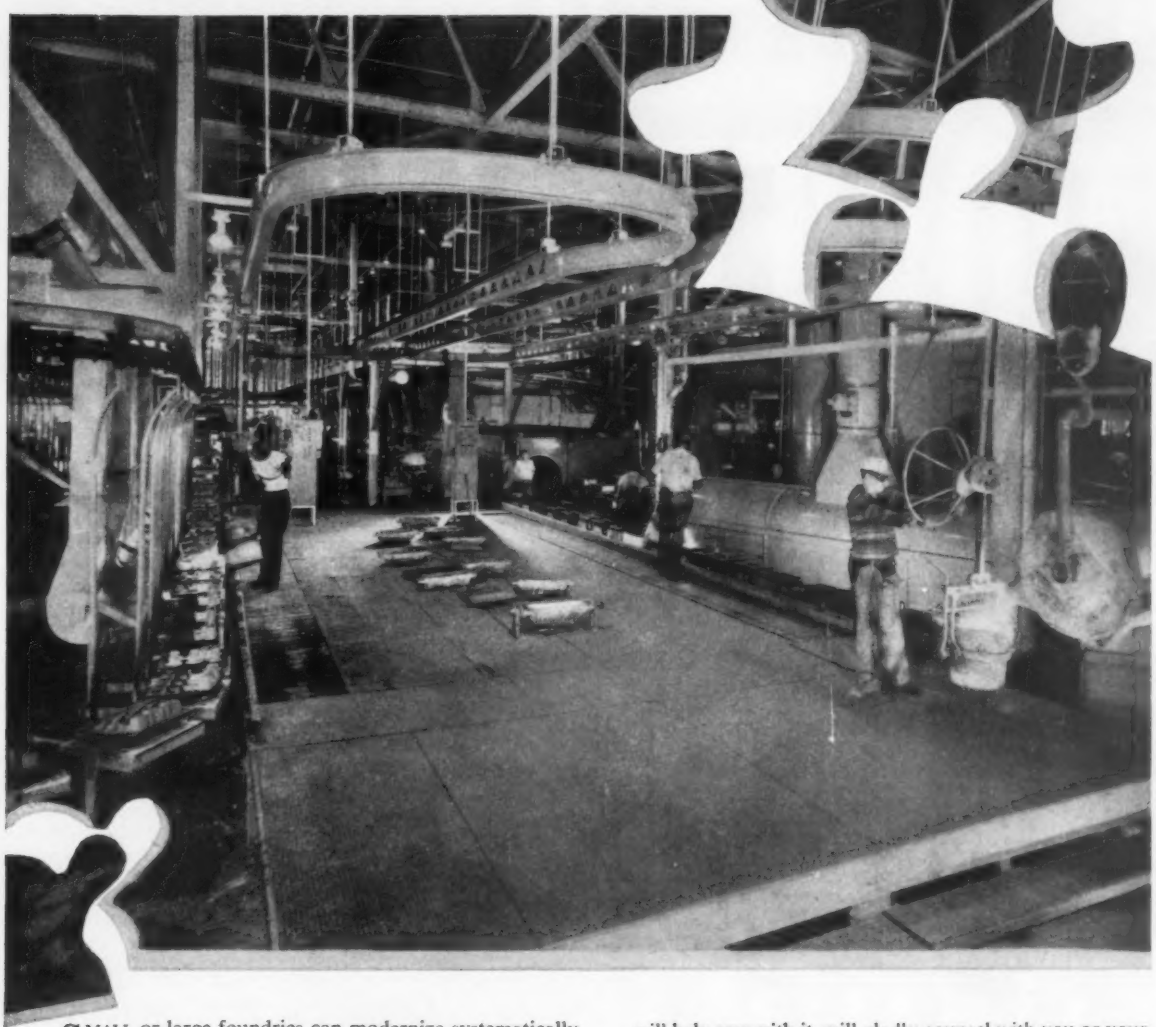
My apologies to the Chicago *Tribune*. F.G.S.

Circle 562 on Page 53

Set your own pace to modernization---

mechanize step by step

with LINK-BELT equipment



SMALL or large foundries can modernize systematically with the help of Link-Belt planning . . . perfected through 50 years of serving foundries. Industry's broadest line of conveyors and preparation machinery allows you to add equipment where it's needed most . . . *piece by piece at your own pace.*

Start anywhere! Whether it's the handling of sand, cores, molds, castings . . . or a complete system—Link-Belt will furnish and install equipment that results in lower costs, more efficient operation, better working conditions.

For best results, step-by-step mechanization requires a sound, long-range program. Our foundry specialists will help you with it, will gladly counsel with you or your consultants. Write our Executive Offices for color-sound film, "Foundry Flexibility," showing the benefits of mechanization. It will be lent on request.

LINK-BELT

CONVEYORS AND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 15.014

THE INDUSTRIAL TRACTOR SHOVEL THAT

COMPARE

COMPARE YALE FOR POWER, ACTION, SAFETY, DESIGN.

Industrial plants from coast to coast—in Canada and Latin America—have accepted the Yale Industrial Tractor Shovel as the pacesetter of the field. Compare Yale's exclusive features and you'll understand why.

POWER

ONLY YALE GIVES YOU MATCHED TORQUE TRANSMISSION!

72-hp. 6-cylinder engine provides smooth power through matched torque converter and Yale torque transmission (fully automatic). One-speed range forward—one-speed range back. Inching control for delicate close-quarter maneuvering. Extra punch for impact loading. Accelerates to 13 mph. in 5½ seconds.

ACTION

ONLY YALE GIVES YOU A PERFORMANCE COMBINATION LIKE THIS!

2500-lb. carry capacity. Exclusive 45° bucket tipback permits faster loading and lowest carry position for faster transport with minimum spillage. 6' dumping clearance for dumping into bins and hoppers out of range of other—even larger—tractor shovels. Shortest turning radius—only 73".

SAFETY

ONLY YALE GIVES YOU BOTH THESE IMPORTANT SAFETY FEATURES!

Safety-curve lifting mechanism members never rise alongside the operator. Front and rear working lights give additional security.

DESIGN

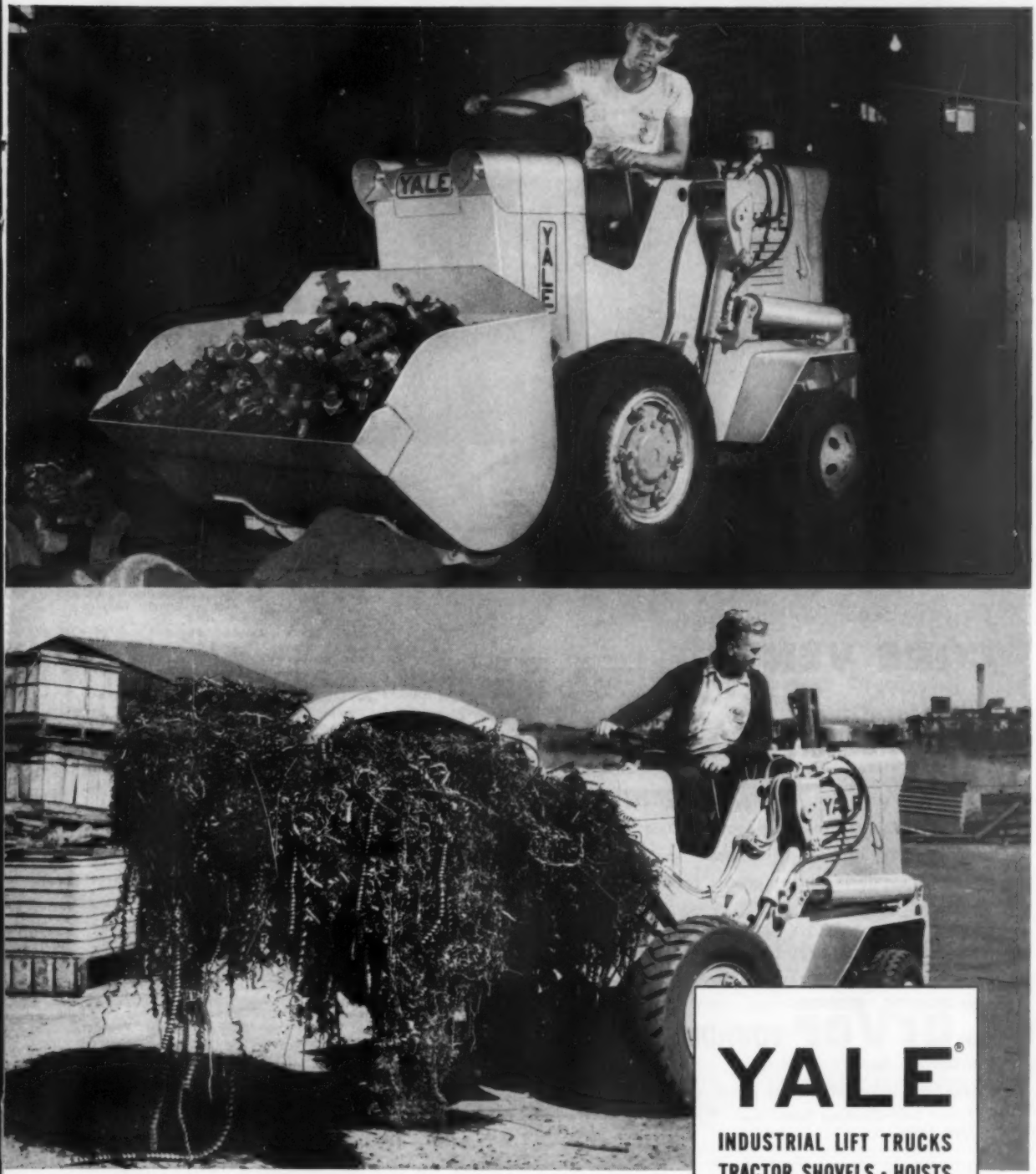
ONLY YALE GIVES YOU THIS COMBINATION OF DESIGN FEATURES!

Rugged, simplified design! Sealed brakes and electrical system! Protected steering linkage! 10-ply tires! Whatever the job requirement—all these features add up to a more efficient performance at less cost—25% more work per hour. Full range of buckets and attachments available.

Leading companies throughout the country are productively using the Yale Industrial Tractor Shovel. Names on request.

For a demonstration in your plant or full data, contact your Yale representative. Or write The Yale & Towne Manufacturing Company, Yale Materials Handling Division, Philadelphia 15, Pennsylvania, Dept. YT-3V.

SETS NEW PERFORMANCE STANDARDS FOR INDUSTRY



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TRACTOR SHOVELS • HOISTS

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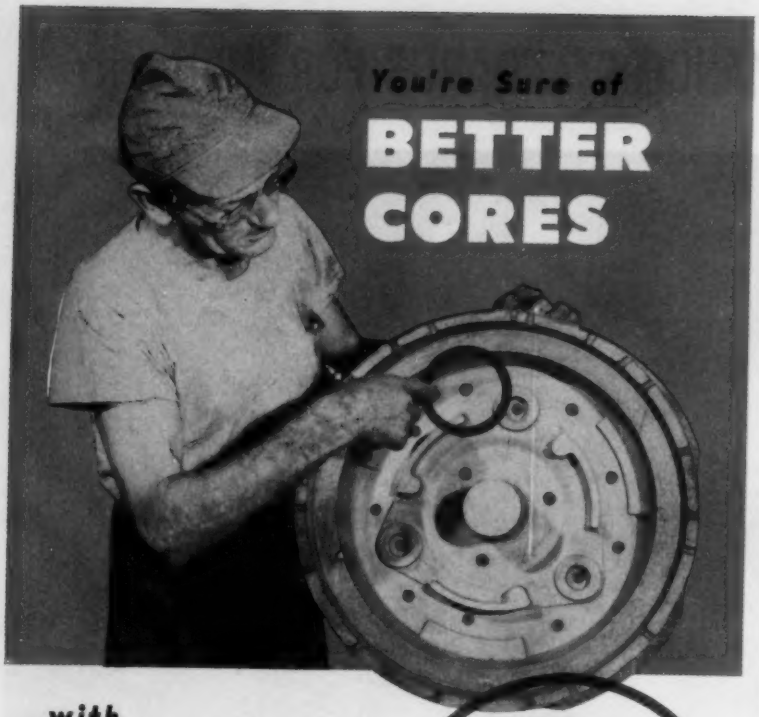
Circle 564 on Page 53



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Self-Cleaning

Taper Slot

CORE VENTS

Krauss Core Vents are knurled on sides to assure greater gripping power.
Underface — reinforcing rings prevent slots from closing when core vents are hammered into place.

Will Not Clog . . .
Leaves No Mark!

Because the slots are *always open,* cores are harder packed, with no air cushions to cause soft spots. Krauss Taper Slot Core Vents eliminate clogging . . . which means less frequent cleaning. This results in less down time — greater production time. Mail coupon for prices.

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Muscatine, Iowa

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NAME _____ TITLE _____

FOUNDRY _____

CITY _____ STATE _____

CALENDAR of Meetings

Sept. 13-18—American Chemical Society, fall meeting, Convention Hall, Atlantic City.

Sept. 16-17—American Die Casting Institute, Edgewater Beach Hotel, Chicago.

Sept. 18—Malleable Founders' Society, industry meeting, Hotel Sheraton - Cleveland, Cleveland.

Sept. 21-22—Steel Founders' Society of America, fall meeting, Homestead, Hot Springs, Va.

Sept. 21-25—Instrument Society of America, annual Instrument-Automation Conference and Exhibit, International Amphitheatre, Chicago.

Sept. 24-25—Missouri Valley Regional Foundry Conference, Missouri School of Mines & Metallurgy Rolla, Mo.

Sept. 28-Oct. 1—American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

Sept. 28-Oct. 1—Association of Iron & Steel Engineers, annual convention, Sherman Hotel, Chicago.

Oct. 1-2—Central New York Regional Foundry Conference, Drumlins Country Club, Syracuse, N. Y.

Oct. 2-3—Northwest Regional Foundry Conference, Benjamin Franklin Hotel, Seattle.

Oct. 4-10 — International Foundry Congress, organized by Spanish Institute of Iron & Steel, Madrid, Spain.

Oct. 7-9—Gray Iron Founders' Society, annual meeting, Fairmont Hotel, San Francisco.

Oct. 8-9 — Michigan Regional Foundry Conference, Pantlind Hotel, Grand Rapids, Mich.

Oct. 11-16—American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

Oct. 15-17—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

Oct. 16-17—New England Regional Foundry Conference, Massachusetts Institute of Technology. Cambridge, Mass.

Oct. 19-20 — Magnesium Association, annual convention, Hotel Roosevelt, New York.

Oct. 19-23—National Safety Council, annual Safety Congress and Exposition, Conrad Hilton Hotel, Chicago.

Oct. 21—Cast Bronze Bearing Institute, annual meeting, Bedford Springs Hotel, Bedford Springs, Pa.

Oct. 22-24—Non-Ferrous Founders' Society, annual meeting, Bedford Springs Hotel, Bedford Springs, Pa.

Oct. 22-23—Ohio Regional Foundry Conference, Desh'er-Hilton Hotel, Columbus, Ohio.

Oct. 29 30—Purdue Metals Casting Conference, Purdue University, Lafayette, Ind.

Nov. 2-6—American Society for Metals, National Metal Exposition & Congress, International Amphitheatre, Chicago.

Nov. 3-4—Investment Casting Institute, annual meeting, La Salle Hotel, Chicago.

Nov. 5-6—National Foundry Association, annual meeting, Hotel Roosevelt, New York.

Nov. 9-11—Steel Founders' Society of America, Technical & Operating Conference, Carter Hotel, Cleveland.

Dec. 2-4—Metallurgical Society, American Institute of Mining, Metallurgical, and Petroleum Engineers, Electric Furnace Conference, Hotel Sheraton-Cleveland, Cleveland.

1960

Jan. 15—Malleable Founders' Society, semi-annual meeting, Hotel Sheraton-Cleveland, Cleveland.

Feb. 4-5—Alloy Casting Institute, midwinter meeting, Hotel Key Biscayne, Key Biscayne, Fla.

Feb. 11-12—Wisconsin Regional Foundry Conference, Schroeder Hotel, Milwaukee.

Feb. 18-19—Southeastern Regional Foundry Conference, Thomas Jefferson Hotel, Birmingham.

Feb. 24-25—Malleable Founders' Society, Technical and Operating Conference, Cleveland.

Mar. 7-8—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

Mar. 16-17—Foundry Educational Foundation, annual college-industry conference, Hotel Statler-Hilton Cleveland.

Apr. 13-14—Malleable Founders' Society, Market Development Conference, Edgewater Beach Hotel, Chicago.

May 9-13—AFS 64th Annual Castings Congress & Foundry Show, Convention Hall, Philadelphia.

June 6-7—Malleable Founders' Society, annual meeting, Elbow Beach Surf Club, Hamilton, Bermuda.

Circle 565 on Page 53

THOUSANDS OF Carver RAPID MULLERS NOW IN USE

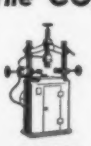
The most POPULAR, most PRACTICAL muller on the market . . . Here's why . . .

- The fastest! A batch every 75 seconds!
- Absolutely *no* lumps or wet spots!
- Easiest to clean! Just reach inside
- Only *one* moving part . . . no maintenance worries!
- 3 times lower initial investment than with most mullers!
- Works equally well with *any* kind of binder!

IF YOU COMPARE MULLERS CAREFULLY . . . YOU'LL CHOOSE CARVER

Only Carver Has Everything For the CO_2 Process!

CARVER V & S Core Shooters



CARVER Automatic Gassing Apparatus

KRAUSS Taper Slot Core Vents

STEINEX available only from CARVER

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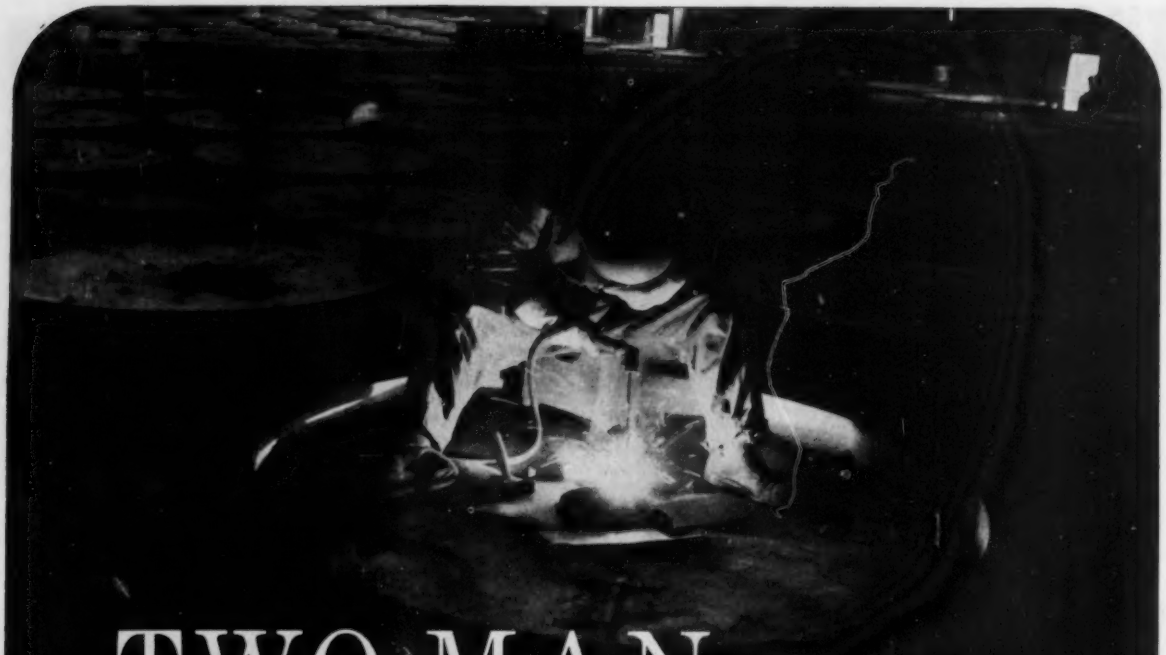
I want to compare! Tell me more about Carver Rapid Muller.

NAME _____ TITLE _____

FOUNDRY _____

CITY _____ STATE _____

Circle 566 on Page 53



TWO MAN TEAM

Users of Ansco X-ray films know that it's like having an extra man on every weld whenever Ansco is on the job. That's because Ansco films provide a certainty that often means dramatic savings in quick, easy flaw detection.

Superb gradation and subtle tonal separation are characteristics of all Ansco X-ray films. That's because Ansco X-ray films are critically coated to tolerances that provide unequalled quality and uniformity year in and year out.

Try *ANSCO SUPERAY 'A'* whenever fast, fine grain, high-speed results are needed. *ANSCO SUPERAY 'B'* is the natural choice for extreme contrast and ultra-fine grain. *ANSCO SUPERAY 'C'* is a very high speed film for gamma radiography.

Try these films soon . . . you'll have another man on the job. Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corporation.

Ansco

Industrial X-ray

· Circle 567 on Page 53

Keep high alloy melts CLEAN

Photo courtesy Arwood Precision Casting Corporation.

. . . with Norton Crucibles

You can pick the exact type of crucible you need for precision casting of high alloy steels from the wide NORTON line and have excellent protection against contamination.

No other crucibles give you such high stability to both heat and chemical action under a wide range of operating conditions. What's more, their fine, smooth surfaces are invaluable wherever molten metal must be kept free of refractory inclusions.

Specifically engineered for use in induction-type and indirect arc furnaces, these rugged NORTON Crucibles are ideal aids to critical casting techniques where both high precision and purity of the molded part are essential.

NORTON Crucibles can increase the precision, efficiency and economy of your casting operations. They're available in a wide variety of sizes. Get full details from your NORTON representative. And write for this new informative catalog on the *complete* line of NORTON Crucibles. NORTON COMPANY, Refractories Division, 311 New Bond Street, Worcester 6, Massachusetts.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

MAGNORITE* K Crucibles (97% Fused Magnesia)
Widely used for melting steels and ferrous alloys as well as cobalt, chrome, copper, bronzes and nickel.

MAGNORITE M Crucibles (99% Fused Magnesia)
Designed to meet refractory requirements calling for low boron, iron oxide, and silica content.

ALUNDUM* A Crucibles (99% Alumina)
Provide outstanding stability in both oxidizing and reducing atmospheres. Ideal for vacuum melting.

ZIRCONIA H Crucibles (Fused Stabilized Zirconia)
For operations where extremely high refractoriness and low thermal conductivity are required.

CRYSTOLON* Silicon Carbide Crucibles and other types of crucibles also available for melting nonferrous metals and alloys.

NORTON
REFRACTORIES
Engineered... Ry...Prescribed

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Circle 568 on Page 53

Need technical or practical foundry advice?

Call for

REPUBLIC'S 3-DIMENSION METALLURGICAL SERVICE

Republic provides a unique pig iron metallurgical service to foundrymen everywhere. This service utilizes the combined knowledge of field, mill, and laboratory metallurgists. It is based on the premise that pig irons behave in different ways, in different foundries, under a variety of operating conditions.

How 3-D Service works for you. The field metallurgist, first man on the team, visits your foundry. He talks to your production people, finds out what their problems are, what they expect the pig iron to do. Being both a practical foundryman and skilled technician, the field metallurgist is frequently able to provide an on-the-spot solution. His recommendations often result in improved operations, increased efficiency, and output at lower cost.

Should your problem involve metals research or chemistry, the field metallurgist checks with the other two members of the service team—the mill and laboratory metallurgists.

All three men then focus their attention on your problem. Their recommendation, based on your objectives, your costs, your equipment, is passed on to your personnel by the field metallurgist. He works with them to see that your problem is solved satisfactorily, right in your foundry.

Why not call for Republic's 3-Dimension Metallurgical Service the next time you need practical or technical foundry advice? Or before you start a new job or an old job with new specifications. This service is obligation-free. The coupon will let us know if you would like a field metallurgist to call.

REPUBLIC METALLURGICAL SERVICE provides a solid foundation for industry's most complete line of merchant pig iron—Chateaugay, Northern Basic, Foundry, Bessemer, and Malleable; Southern Basic and Foundry. With this choice, Republic metallurgists are able to recommend the best and most economical grade for your specific job without hesitation or prejudice.

REPUBLIC PB-127 COLLAPSIBLE BOXES are ideally suited to storing and shipping castings. Heavy-duty corrugated design provides needed strength, delivers long, efficient service at lowest per-year cost. Boxes can be tiered when loaded or empty, collapsed or set up. All parts are permanently attached. The PB-127 Box and Skid Unit offers up to 66% savings in storage space when collapsed. Send coupon for full facts.

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World's Widest Range of Standard Steels and Steel Products

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Send more information on:
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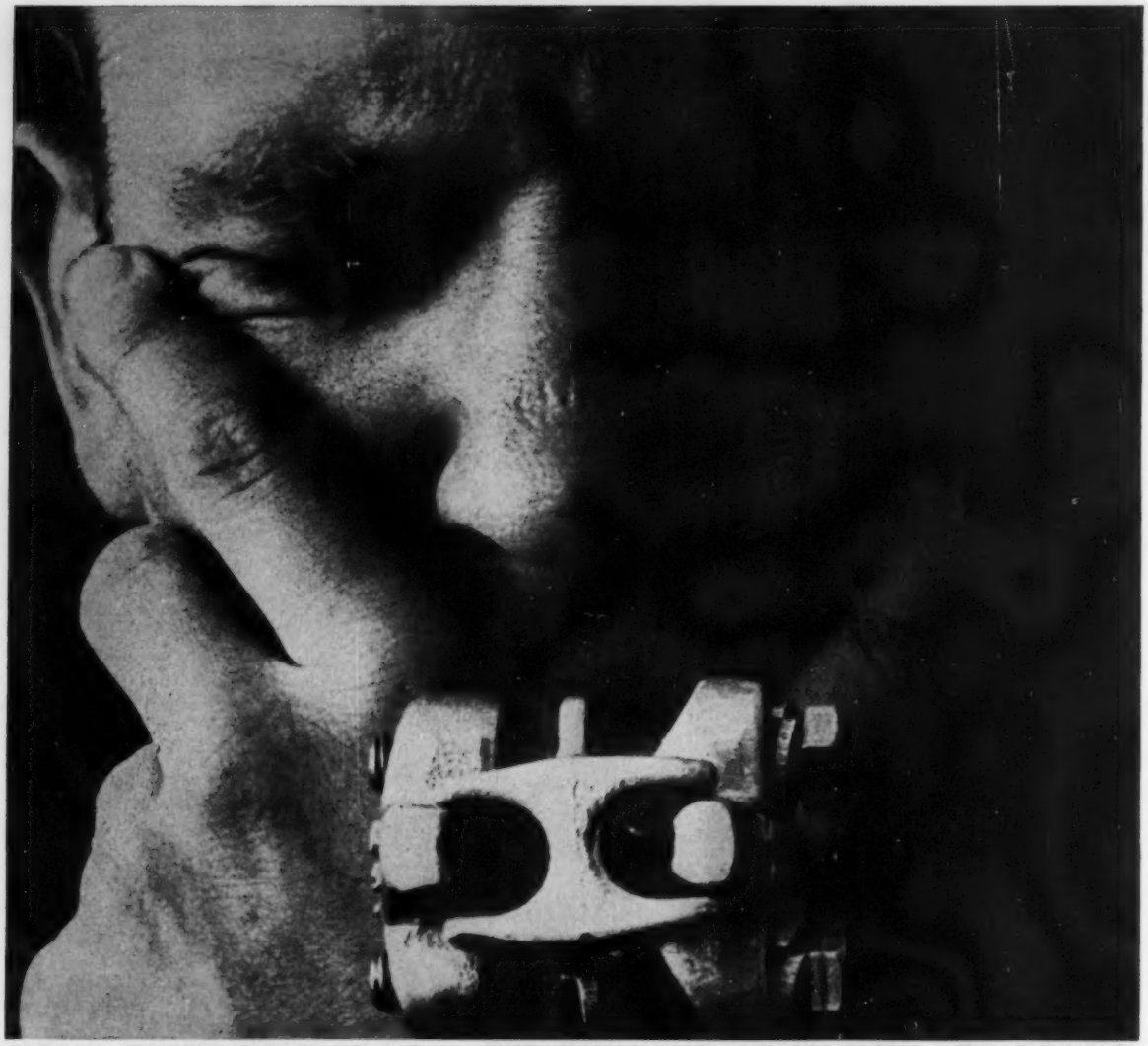
Circle 569 on Page 53



THE CURIOUS CASE OF THE FRACTURED CLAMPS

Another costly mystery solved–by the man from Kaiser Aluminum

THE PUZZLING FACTS. A customer of Kaiser Aluminum had been manufacturing an electrical connector clamp from a casting of primary standard 356 aluminum alloy. But—he often experienced difficulties due to cracking and breakage in use. What to do?

HOW THE CASE WAS SOLVED. After an on-the-scene check, the man from Kaiser Aluminum came up with the answer. His recommendation: use Kaiser Aluminum alloy A-356, a *high purity* alloy specially developed to provide greater ductility and strength in just such castings as these. Result: a superior clamp that developed a reputation of reliability for the manufacturer—and much additional business.

WE LOVE A MYSTERY. This is one of many actual cases solved by Kaiser Aluminum working with a customer. Perhaps *you* have a mystery one of our technical engineers might help solve? He's ready to give you expert advice on any casting problem—including mold and die design, alloy selection, heat treatment, finishing, fluxing, metal transfer.

FULL ALLOY AVAILABILITIES. Kaiser Aluminum can supply you *fast* with a wide selection of casting alloys to suit any engineering requirement—from general purpose, low stressed alloys to alloys having good properties at elevated temperatures.

FOR PIG AND INGOT with a free sleuthing bonus, call your nearest Kaiser Aluminum sales office now. Or write to: Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California.

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

POSITIVE DUPLICATION—EVERY TIME!

To "true" vertical lines, today's home builders depend on the familiar plumb—just as pyramid-building Egyptians did 5,000 years ago. The plumb's action and accuracy are always the same.

You can depend on the action and accuracy of these CINCINNATI (PD)° Floor Stand WHEELS (and *all* CINCINNATI WHEELS) . . . because you get Positive Duplication, time after time after time.

36 REASONS WHY

CINCINNATI WHEELS do a better job for you, because 36 separate quality control steps in the unique (PD) process result in wheels of unsurpassed uniformity.

Your cleaning room costs go down when you use (PD) WHEELS. They last longer. Their balanced action, Cincinnati built-in, gives your operator a smoother cutting, safer cutting wheel.

CUT COSTS . . . CALL CINCINNATI

One of our grinding specialists will be happy to help you find the best grading for your stand, swing frame and portable grinders. You *keep* those costs 'way down, because each reorder CINCINNATI (PD) WHEEL will act and grind exactly like the original wheel . . . thanks to Positive Duplication.

Call your CINCINNATI (PD) GRINDING WHEELS distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI° GRINDING WHEELS

°Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

Circle 571 on Page 53

A Timely Message For Foundry Managements

what are YOUR foundry problems?

Check this list of KNIGHT SERVICES FOR FOUNDRIES

- ☐ Plant Layout
- ☐ Cost Control
- ☐ Methods
- ☐ Modernization
- ☐ Mechanization
- ☐ Materials Handling
- ☐ Automation
- ☐ Organization
- ☐ Production
- ☐ Job Evaluation
- ☐ Wage Incentive

The quickest, easiest and most practical way to solve any foundry problem that is restricting your production or increasing your costs is to use the dependable services of experienced Knight Engineers. Regardless of the type or size of your foundry—or your problems—Knight Engineers can be of unusual help.

For consultation on any foundry problem, large or small, call on Lester B. Knight & Associates, Inc.

Lester B. Knight & Associates, Inc.

Management, Industrial and Plant Engineers

Member of the Association of Consulting Management Engineers, Inc.

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New York Office—Lester B. Knight & Associates, Inc., Management Consultants, 500 Fifth Ave., New York 36

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Circle 572 on Page 53

Circle 573 on Page 53→

Sharper casting detail with FEDERATED phosphor copper. When you add phosphor copper to reduce porosity, increase castability, and assure sharper detail, guarantee yourself finest performance with Federated quality material. Like the famous Federated line of aluminum and copper base alloys, phosphor copper is produced under the strictest metallurgical controls in the industry. It is stocked as shot or waffle in a nation-wide network of warehouses for immediate shipment. Federated Metals Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. In Canada, Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

"Bakeless" cores and molds in 20 seconds

Liquid Carbonic's Improved CO_2 Process Sparks Revolutionary Advances in Core-Hardening

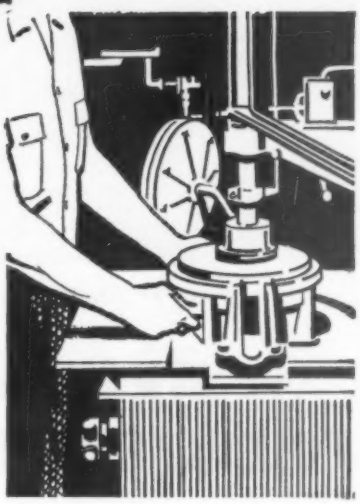
Requests for "we-need-it-tomorrow" deliveries seem to cram a foreman's order pad every day. Until now, immediate delivery has been a source of concern to the foundry industry because of lengthy baking and drying procedures.

Because of this, more and more foundries are adopting the bakeless CO_2 core-hardening process. Intricate cores can be made with CO_2 in a matter of seconds; completely finished cores (rammed, gas-hardened and removed) are produced in less than three minutes. Thus, CO_2 has become the propelling ingredient in production boosts throughout the country—so much so that it promises to soon become the method of core-hardening.

Speed . . . And Other Advantages

Actually, it's simply a matter of supply and demand: the great demand today is for speed—therefore, CO_2. It doesn't just end there . . . the CO_2 process makes other core-making techniques old-fashioned. For example:

1. Eliminates baking ovens and core dryers
2. Better dimensional stability
3. Smoother finish on castings
4. Excellent shakeout and collapsibility
5. Reduces production costs
6. Minimizes rejects
7. Eliminates excessive core inventory
8. Expedites emergency orders
9. Simplifies core design
10. Adaptable for automation



CO_2 Ideal for Mold-Hardening, Too

In addition to these advantages, many foundries have discovered that CO_2 is just as beneficial in mold-making as it is in core-hardening. Dry sand molds sometimes require baking at 300° to 400° F. for periods up to 75 hours; the CO_2 process can do the same job at time-savings up to 95%. CO_2 molding also can save as much as 90% in machine-shop costs, cuts labor requirements, and works equally well on both large- and small-size molds.

Although CO_2 is a relative newcomer to core-making, many improvements have already been made since it was first introduced. A trained staff of Liquid Carbonic engineers have been working for years to improve the CO_2 process. The combination of research, development, and daily shop practice, has brought the CO_2 process up to today's high standards, making it the preferred method of core- and mold-hardening in today's foresighted foundries. Call your Liquid Carbonic representative today and have him show you how CO_2 can improve your production!

How much do you know about sand reclaiming? For an authoritative, educational article, send in the coupon below.

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Please send me your Foundry Bulletin:

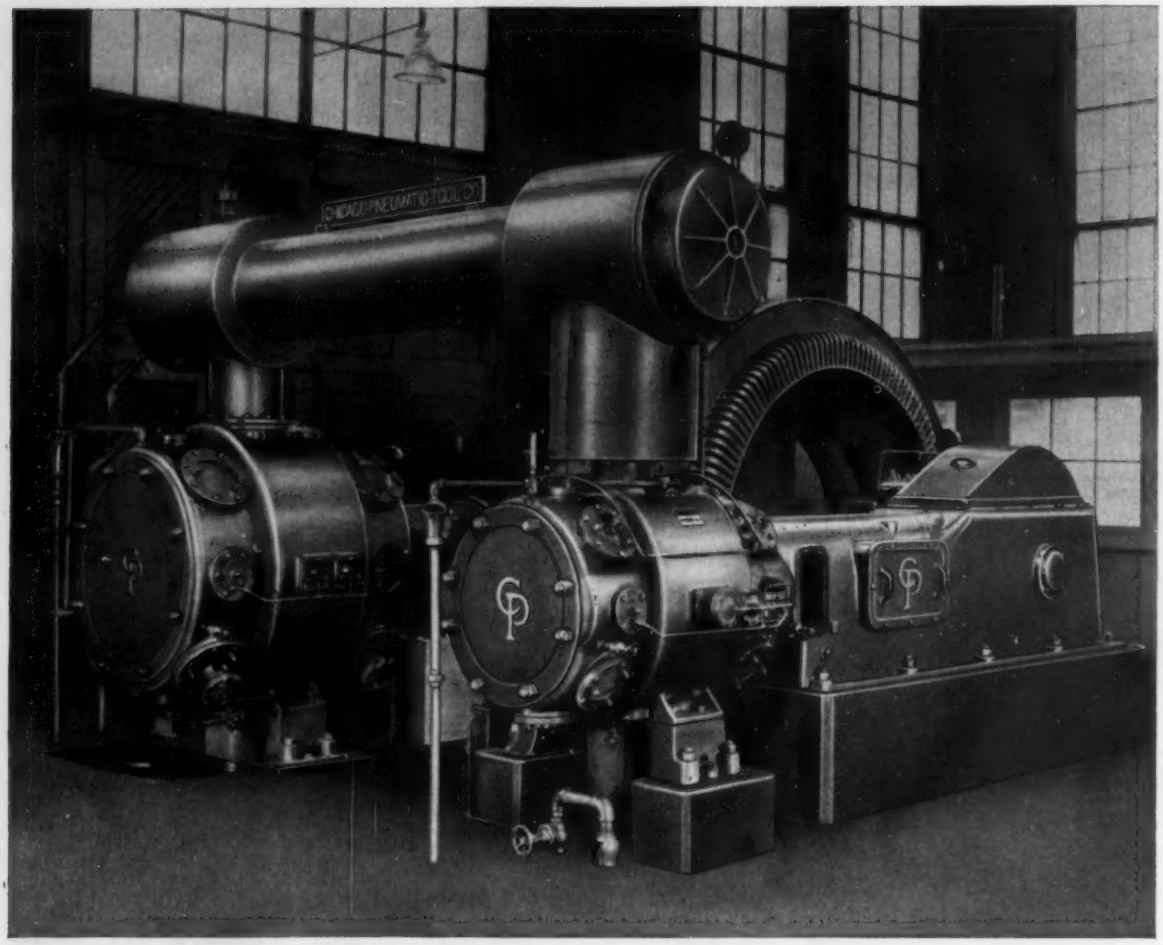
Name.....

Company.....

Address.....

City..... Zone.... State.....

Circle 574 on Page 53



CP Class O-CE, Two-Stage, Motor-Driven Compressor

WHEN YOU PICK A CP HEAVY-DUTY YOU'VE FOUND YOUR FOUNDRY COMPRESSOR

CP Class O-CE Horizontal Duplex Compressors have built their reputation on long life and low maintenance cost. Direct-driven by engine-type synchronous motors. Available in sizes 300 HP and larger.

Also widely used for heavy-duty foundry work is the Class "Y", double-acting, "package type" CP Compressor, in sizes from 75 to 300 HP.

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

AIR AND GAS COMPRESSORS • VACUUM PUMPS • PNEUMATIC TOOLS • ELECTRIC TOOLS • DIESEL ENGINES • HYDRAULIC TOOLS

Circle 575 on Page 53

Beach wear by Jantzen

"SEMI-STEEL"

STEEL-TYPE ABRASIVES

Fastest growing abrasives on the market, because they provide faster and better cleaning than do steel abrasives costing upwards of $50 *more* per ton. "SEMI-STEEL" abrasives last just as long and are easier on equipment, too. You can't help but cut cleaning costs — we'll even guarantee it — in writing! All this and prompt delivery, too, because "SEMI-STEEL" is manufactured in high-speed, mass-production equipment. Why not take advantage of these many advantages? Send for bulletin and free samples of shot and grit. Write, wire or phone — collect!

Inquire, too, about our free engineering service and lab tests — and our low prices on malleable and chilled abrasives.

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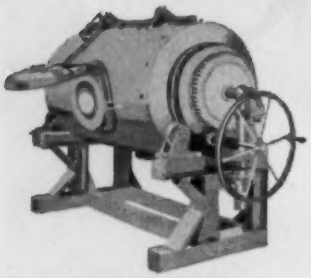
$155.00 PER TON

"SEMI-STEEL" IS MANUFACTURED AS SHOT AND GRIT TO S.A.E. SPECIFICATIONS.

50 OR 100 LB. BAGS, PALLETIZED IF DESIRED.

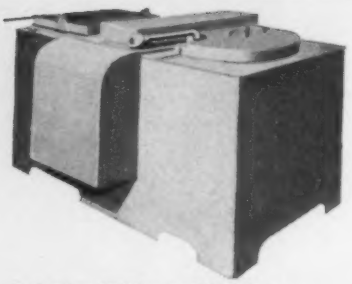
Circle 576 on Page 53

Wherever industry needs heat... There's LINDBERG equipment just right for the specific job

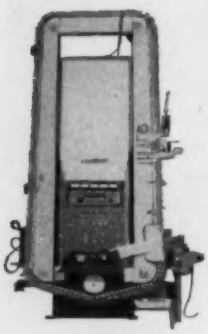


Rotary Open-Flame Smelting Furnaces: Lindberg-Fisher Simplex (shown) either oil or gas fired with capacities to 30,000 lbs. brass, 2,400 lbs. aluminum.

Automatic Ladling Units: The Autoladle "Little Joe". The first practical automatic aluminum ladling unit yet devised.

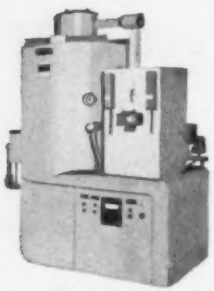


Induction Melting and Holding Furnaces: Lindberg-Fisher two-chamber furnace (shown) melts in one chamber, holds at correct temperature in other.



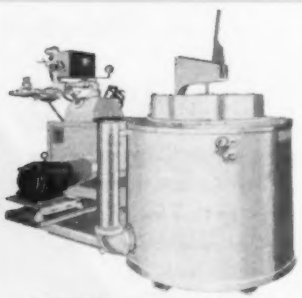
High Frequency Units: Vertically designed, completely automatic "HF" unit (Shown) for aluminizing automotive valves.

Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.

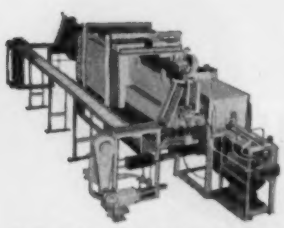


Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.

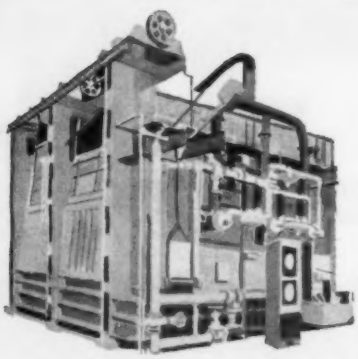
Pilot Plant Equipment: Atmosphere tube unit (shown) for ceramic research and development at temperatures up to 2750° F.



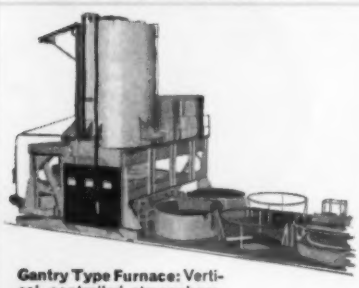
Cyclone Tempering Furnaces: Batch type fuel-fired tempering furnace (shown). Famous in metal treating industry for years.



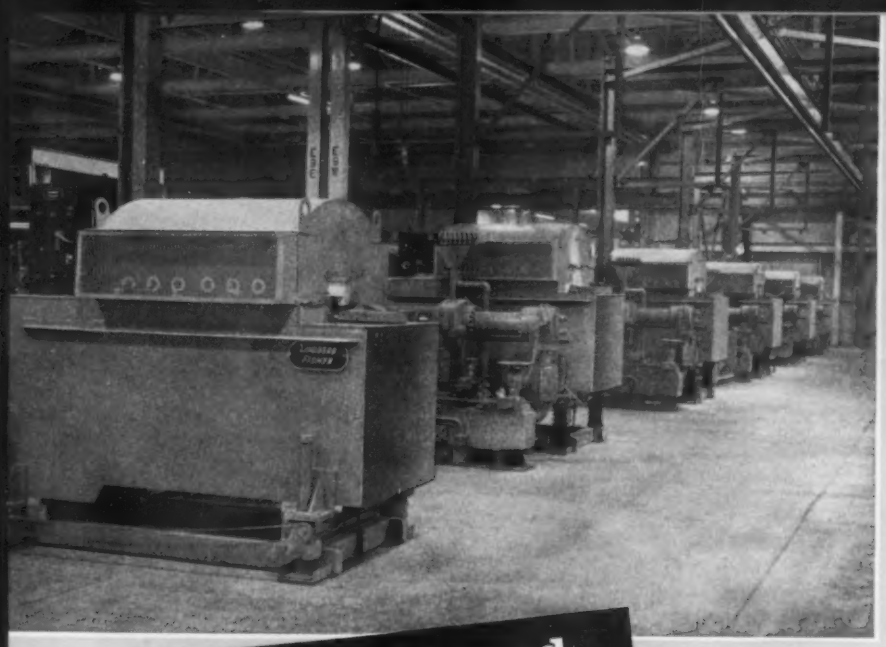
Ceramic Kilns: Fully automatic, atmosphere controlled kiln (shown) has 5 control zones for flexibility. Maximum temperature, 2700° F.



Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.



Gantry Type Furnace: Vertical, controlled-atmosphere, drop bottom, hardening furnace. Complete installation field-installed by Lindberg.



Lindberg-Designed

furnaces, more than 75 of them, help Ford Motor Company maintain casting production and quality standards

The new Aluminum Castings Plant of Ford Motor Company, Engine and Foundry Division, at Sheffield, Alabama, is a model of modern production efficiency. Contributing to its effective operation is a huge battery of Lindberg-Fisher aluminum holding furnaces, more than 75 of them. Eight large 65,000 lb. capacity reverberatory holding furnaces receive molten aluminum delivered from an adjacent Reynolds Metals plant and hold it at the desired temperature. Six other reverberatory furnaces, each with 20,000 lb. capacity, are used for remelting scrap aluminum from trimmed parts and holding metal at its usable temperatures. Molten metal is then delivered to more than 60 electric resistance holding furnaces in the casting area as needed. This unique installation, developed by Ford engineers in conjunction with Lindberg, is a major factor in maintaining the high quality product and production standards required by Ford.

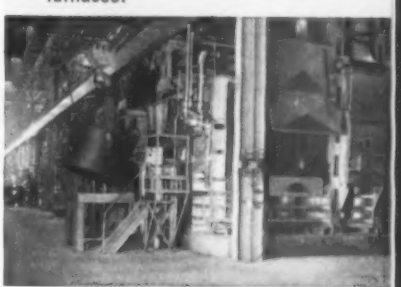
Lindberg equipment and Lindberg planning can help you find the most effective answer to any problem of applying heat to industry. We cover the field, melting and holding, heat treating, tempering, brazing, enameling furnaces, ceramic kilns, high frequency units, and are in the ideal position to recommend just the type of equipment most suitable for your needs. This can be factory built or field-installed in your own plant, fuel-fired or electric. Consult your local Lindberg Field Representative (see the classified phone book) or get in touch with us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2453 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California.

Handsome entrance to new plant of Ford Motor Company, Sheffield, Alabama.

Metal temperatures are positively controlled through Lindberg Control Panel.

Some furnaces are arranged for hand ladling and others are equipped with Lindberg Autoladle.

Molten aluminum is delivered direct to reverberatory holding furnaces.

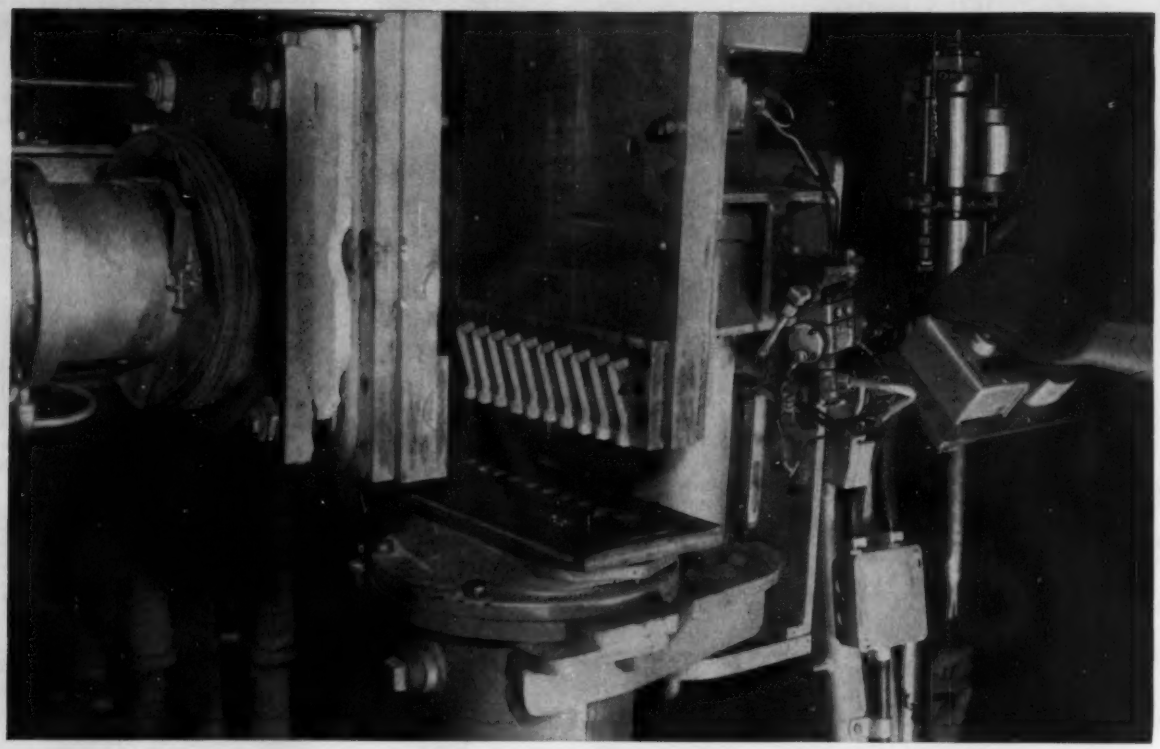


The molten metal is held in these 14 huge furnaces for distribution to the casting areas.

LINDBERG heat for industry

Circle 577 on Page 53

FAST, INEXPENSIVE AUTOMATION OF SHELL CORE BLOWER



with Bellows "Controlled Air Power"

Management of progressive Canton Malleable Iron Co., Canton, Ohio turned to Bellows "Controlled-Air-Power" to automate a Shalco Model MC-5 Shell Core Blower. Now, a woman operator can consistently produce 4500 top quality cores per day without fatigue.

At the push of a button, interlocked and synchronized Bellows "Controlled-Air-Power" Devices advance the core body and sand hopper cylinders, roll the unit over 180°, release the sand-resin mix, expedite and time its flow, return the entire assembly to its original position, and retract the core body and sand hopper cylinders . . . all automatically! The operator merely loads, presses a button and unloads.

This is only one example of practical, low-cost "spot-a-mation" of various foundry operations with Bellows equipment. It is described in detail, with equipment list and wiring diagram, in Bellows "Spot-A-Mation" Idea File 11.0-8. For your free copy, address Dept. FO-959, The Bellows Co., Akron 9, Ohio. In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto 18.

1344-B

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

AKRON 9, OHIO

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

Circle 377 on Page 53

Late News

PRODUCTIVITY UP: Increased production efficiency has accompanied the upturn in castings demand this year. Relating shipments of castings to number of production workers, based on government figures, the ratio for the first four months of 1959 shows an increase of 15 per cent compared with the average for 1957-58. The improvement over the average for 1953-56 is 18 per cent and over the 1949-52 average it is 28 per cent.

TRENDS: Production of gray iron castings in the first half of this year totaled about 7 million tons, 40 per cent more than a year ago. Improvement compared with 1958 varied somewhat among the other types of castings. For steel it was slightly over 20 per cent, brass and bronze 25 per cent, aluminum 42 per cent and malleable iron 50 per cent. These gains are not expected to be maintained for the year as a whole because the second-half in 1958 had more than a seasonal upward trend. The steel industry strike also will be a deterrent.

PERSONALS: Warner B. Bishop, recently vice president, Archer-Daniels-Midland Co., has been made vice president for sales, Basic Inc., Cleveland. Harvey N. Barret Jr., Basic vice president, has been placed in charge of its new markets development division . . . Warren W. Brown has been named manager of market development, Massillon Steel Casting Co., Massillon, Ohio. He was formerly sales manager, Superior Foundry Inc., Cleveland . . . Harvey E. Henderson, recently project engi-

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

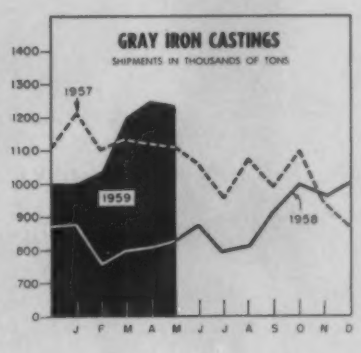
	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1957	65,688,592	9,220,405	1,020,951	5,876,400
1958				
Mar.	3,718,132	524,165	84,864	524,035
3 mo.	11,281,644	1,940,213	206,826	1,556,917
Apr.	3,429,121	599,427	61,839	631,220
May	3,862,491	596,253	59,060	553,756
June	4,409,006	615,271	62,703	605,733
July	3,716,739	543,726	47,203	513,394
Aug.	4,203,034	580,844	66,877	592,727
Sept.	4,472,219	680,660	71,196	637,400
Oct.	5,091,207	707,378	90,707	757,722
Nov.	4,803,615	700,704	74,382	691,078
Dec.	4,973,670	761,494	80,593	712,779
Total	50,242,746	7,725,970	821,388	7,152,726
1959				
Jan.	5,375,042	783,045	86,519	767,289
Feb.	5,657,873	791,137	88,326	801,692
Mar.	6,677,499	873,982	101,986	965,048
3 mo.	17,728,414	2,448,164	296,831	2,534,029

Index of Foundry Equipment Orders

Foundry Trades Only
(Net Orders Closed, New Equipment)

	1958	1959
Jan.	87.9	127.4
Feb.	57.6	237.1
Mar.	83.0	166.6
Apr.	88.7	154.2
May	136.1	157.0
June	87.7	125.1
July	77.9	....
Aug.	74.1	....
Sept.	94.5	....
Oct.	118.9	....
Nov.	83.3	....
Dec.	137.0	....

Note: Base period 1947-49 taken as 100 per cent monthly average.
Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings — Total	All Castings — For Sale	Miscellaneous Castings Total	Miscellaneous Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[3]	Soil Pipe & Fittings Total[3]	Unfilled Orders[2]
1957	12,664,504	6,876,497	7,786,239	3,310,915	.....	2,489,296	559,332	1,351,345	758,308	.....
1958										
May	820,054	472,192	469,026	203,025	9,511	134,312	23,498	123,017	70,201	570,293
5 mo.	4,043,903	2,202,618	2,536,496	1,062,016	48,056	632,966	123,146	469,494	281,801	.....
June	867,948	541,904	503,252	245,651	8,951	135,477	22,928	129,671	76,620	572,706
July	791,560	465,650	430,883	185,275	8,696	157,478	19,928	110,790	72,481	580,155
Aug.	802,473	513,862	410,876	205,821	8,323	165,006	18,537	129,157	78,897	614,199
Sept.	916,704	537,717	518,185	227,414	7,902	175,323	20,783	125,693	76,720	644,834
Oct.	992,730	586,614	551,380	253,062	10,857	207,500	22,970	129,375	81,505	619,667
Nov.	958,306	505,290	575,586	231,648	11,731	201,704	18,801	98,326	63,889	602,375
Dec.	997,608	509,499	628,720	246,289	13,072	206,942	18,021	85,179	56,746	606,096
Total	10,371,232	5,863,154	6,155,378	2,657,197	117,588	1,984,396	265,114	1,277,685	788,659	.....
1959										
Jan.	1,001,771	517,390	625,604	250,161	12,061	214,955	27,650	75,571	58,056	637,245
Feb.	1,036,655	538,514	642,882	252,115	12,619	230,706	31,035	76,147	55,885	767,360
Mar.	1,295,572	666,034	701,527	286,692	13,881	270,293	35,520	108,131	89,801	846,937
Apr.	1,245,702	688,755	726,105	295,982	14,663	270,476	35,655	129,861	83,605	892,214
May	1,236,250	685,285	706,073	285,507	16,003	275,563	36,960	141,675	75,979	884,779
5 mo.	5,725,960	3,095,978	3,402,191	1,370,457	69,227	1,262,023	167,120	531,384	363,326	.....

*Source: U. S. Dept. of Interior Bureau of Mines. [1]Source: Bureau of Census. [2]For sale only. [3]All cast iron pipe is shipped for sale.

Late News

neer in the research department, Lynchburg Foundry Co., Lynchburg, Va., has been appointed technical director . . . Albert F. Pfeiffer, consultant, foundry and pattern shops, Allis-Chalmers Mfg. Co., Milwaukee, has retired after nearly 57 years in the patternmaking field . . . R. W. Wilson has been promoted from assistant manager to manager, Foundry Div., American Hoist & Derrick Co., St. Paul . . . Wayne J. Burke, equipment sales manager, Eastern Clay Products Dept., International Minerals & Chemical Corp., has joined the sales staff of Foundry Specialties Mfg. Co., Chicago.

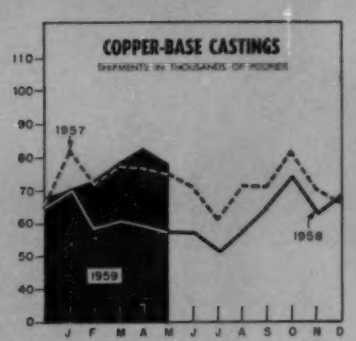
MATERIAL HANDLING: Bookings of material handling equipment manufacturers continue brisk. June order index of the Material Handling Institute was at a 1959 high of 170.7. It is the best in three years and compares with 131.1 a year ago.

MORE MALLEABLE: Capacity of major producers of automotive malleable iron castings has been increased about 18 per cent in preparation for the 1960 model year, the Malleable Founders' Society reports. This increase means an additional 95,000 tons. The society estimates total malleable shipments for 1959 will be 922,000 tons, about half of it for automotive use. Compared with 1958, malleable demand so far this year from non-automotive consumers has picked up faster than from motor car builders.

OBITUARY: Henry F. McFarlin, 63, formerly with Henry M. Wood Co., Cincinnati, died July 16 . . . T. E. Malpass, 54, president, East Jordan Iron Works Inc., East Jordan, Mich., died Aug. 7 . . . W. M. Bering Jr., executive vice president, Chambers-Bering-Quinlan Co., Decatur, Ill., died Aug. 15 . . . Harold B. Gardner, 68, metallurgist, Copper Div., Business and Defense Services Administration, Washington, died Aug. 7.

NEW FOUNDRIES: Abbott Foundry Co. expects to start production of gray iron castings about Oct. 1 at a new $100,000 foundry in Lynchburg, Va. The new company is headed by William T. Abbott, formerly superintendent, Glamorgan Pipe & Foundry Co., Lynchburg. Precise Castings Inc., a new corporation, has

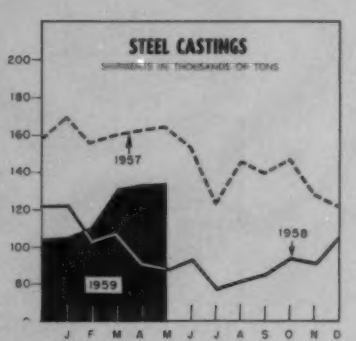
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1957	874,627	789,014	44,789	.....
1958				
May	57,506	51,634	3,077	22,367
5 mo.	305,037	274,785	16,386	.....
June	57,124	51,967	3,001	21,578
July	51,124	46,636	2,351	20,518
Aug.	57,790	52,981	2,425	24,851
Sept.	64,447	58,435	2,388	25,655
Oct.	74,012	67,564	3,239	26,726
Nov.	62,746	57,386	2,604	24,928
Dec.	67,935	61,119	3,535	25,078
Total	740,155	670,873	36,429	.....
1959				
Jan.	70,123	62,266	3,753	25,344
Feb.	72,754	64,558	4,007	26,468
Mar.	78,641	69,472	4,333	29,373
Apr.	82,799	73,567	4,640	29,941
May	78,315	69,253	4,363	27,072
5 mo.	382,632	339,116	21,006	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1957	1,766,191	1,359,747	349,059	1,328,475	1,019,096	324,951	437,713	340,657	24,108	.....
1958										
May	87,002	66,086	10,416	61,195	45,967	9,463	25,897	20,119	933	211,346
5 mo.	508,718	391,827	77,744	366,116	280,157	72,198	142,602	111,670	5,546	.....
June	92,861	71,624	14,185	67,227	50,919	12,987	25,634	20,705	1,198	190,779
July	68,802	48,618	5,400	46,858	32,161	4,656	21,944	16,457	744	200,272
Aug.	80,886	59,816	8,021	57,539	42,069	7,090	23,347	17,447	931	196,300
Sept.	85,277	64,586	9,205	60,392	44,890	7,905	24,885	19,696	1,300	196,482
Oct.	95,389	73,367	12,254	67,906	51,065	10,980	27,483	22,302	1,274	184,925
Nov.	85,267	65,788	9,648	59,793	45,808	8,501	25,474	19,980	1,147	193,960
Dec.	103,800	81,360	13,187	76,015	59,171	11,934	27,785	22,189	1,253	214,352
Total	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959										
Jan.	105,392	82,683	14,408	76,242	59,027	12,948	29,150	23,656	1,460	232,646
Feb.	110,280	86,013	14,686	79,365	61,261	13,316	30,645	24,752	1,370	245,096
Mar.	131,317	103,848	20,086	93,309	75,968	18,410	35,008	27,880	1,676	270,683
Apr.	134,344	104,890	21,372	99,295	76,802	19,761	35,049	28,088	1,611	271,613
May	135,359	105,804	23,825	101,504	78,767	22,496	33,855	27,037	1,327	263,908
5 mo.	616,692	483,238	94,377	449,715	351,825	86,933	163,707	131,413	7,444	.....

[1]Source: Bureau of Census. [2]For sale only.

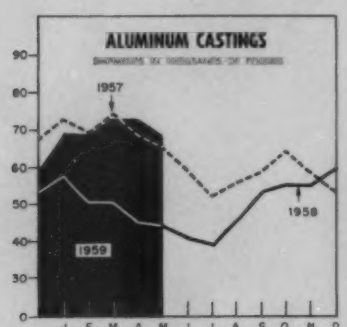
started production of aluminum diecastings at Lafayette, Ind. John P. Sikorski is president.

SUGGESTIONS: The 238 members of the National Association of Suggestion Systems last year paid $13,359,445 to employees for the 427,117 usable ideas submitted. Top award was $32,000 to two blast furnace workers of U. S. Steel at Gary, Ind. The association, 25 East Jackson Blvd., Chicago 4, has just prepared a free booklet describing suggestion systems operation based on combined experience of its members. Further information may be obtained at the annual NASS National Conference, Oct. 11-13, at Hotel Sheraton-Jefferson, St. Louis. It's open to nonmembers.

CAR BUYING: July orders for 4159 freight cars practically matched the 4273 cars built, leaving the backlog of cars on order at 40,309 units. Backlog on Aug. 1, 1958, was 25,994 cars.

DUCTILE IRON PIPE: Production of ductile iron pipe is expected to triple this year to a total of 21,000 tons and to reach 100,000 tons by 1961, according to Donald J. Reese, International Nickel Co. In addition to use for gas and water lines, increasing applications are being found in marine service and in the chemical industry.

MISCELLANY: Empire Pattern & Foundry, Tulsa, Okla., and Empire Foundry Co., Bonham, Tex., are being merged with the Vista Petroleum Co. . . . During the last 20 years more than 3½ million tons of scrap aluminum has been processed into usable metal, according to the Aluminum Smelters Research Institute . . . St. Paul Brass Foundry Co., St. Paul, is tripling its capacity with a new $280,000 plant . . . Glamorgan Pipe & Foundry Co., Lynchburg, Va., has created a new division for the manufacture of plastic pipe . . . Denver Equipment Co. has started an expansion program at its Colorado Springs, Colo., foundry . . . Algonac Foundry Co., Algonac, Mich., has changed its name to Algonac Marine Hardware Co. . . . Primary aluminum production reached a record 179,194 tons in July . . . Orders for industrial furnaces through July were 147 per cent ahead of a year ago, the Industrial Heating Equipment Association reports.



PRODUCTION WORKERS

Estimated Number

	May 1959	Apr. 1959	May 1958
Ferrous	196,000	194,300	159,800
Nonferrous	53,000	52,800	42,700

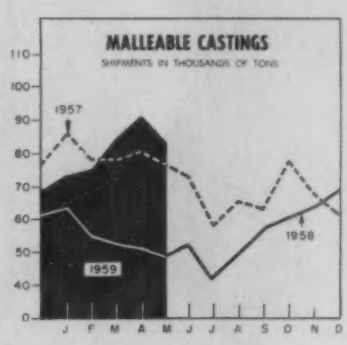
Average Weekly Earnings

Gray Iron	$99.95	$96.96	$80.86
Malleable Iron	97.34	95.99	81.45
Steel	105.22	103.63	87.00
Nonferrous	99.95	98.88	90.87

Average Weekly Hours

Gray Iron	41.3	40.4	36.1
Malleable Iron	40.9	40.5	36.2
Steel	41.1	40.8	36.1
Nonferrous	41.3	41.2	39.0

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1957	751,818	143,991	232,326	373,586	.....
1958					
May	44,093	9,312	13,648	21,091	59,666
5 mo.	248,128	48,479	75,810	123,181	.....
June	40,701	8,644	13,679	18,292	63,670
July	38,818	8,658	12,342	17,714	68,618
Aug.	45,034	9,034	14,426	21,505	71,135
Sept.	52,796	10,261	16,241	26,254	72,819
Oct.	55,699	10,932	17,189	27,511	73,474
Nov.	55,793	10,539	16,942	28,264	76,370
Dec.	59,487	10,874	18,970	29 579	78,732
Total	596,456	117,421	195,599	292,300	.....
1959					
Jan.	68,896	11,238	24,844	32,813	83,314
Feb.	68,381	10,802	25,428	32,147	82,001
Mar.	73,351	12,413	26,964	33,949	82 676
Apr.	72,976	12,700	26,183	33,992	85,636
May	68,279	11,974	25,283	30,893	80,297
5mo.	351,883	59,126	128,672	163,794	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	
1957	862,976	520,118	713,539	431,662	149,437	88,456	.....
1958							
May	48,306	26,656	40,092	21,710	8,214	4,946	46,603
5 mo.	268,103	152,594	222,103	123,545	45,980	28,049	.....
June	51,882	31,077	42 910	25,679	8,972	5,398	48,260
July	41,865	24,478	33,857	20,022	8,008	4,456	58,340
Aug.	49,252	29,414	41,734	24,696	7,518	4,718	55,145
Sept.	56,836	31,989	45,945	26,370	10,891	5,629	58,405
Oct.	60,981	40,014	50,181	31,992	10,800	8,022	63,425
Nov.	63,356	35,221	50,063	28,409	13,293	6,812	66,725
Dec.	68,385	40,041	53 797	32,883	14,588	7,158	65,904
Total	660,650	383,829	540,600	313,597	120,950	70,242	.....
1959							
Jan.	73,186	43,667	56,700	35,139	16,486	8,528	77,322
Feb.	74,760	42,693	57,573	31,976	17,187	10,117	90,291
Mar.	84,335	49,690	67,439	40,515	16,896	9,175	95,822
Apr.	90,974	54,306	75,583	43,835	18,391	10,471	102,508
May	83,472	49,619	66,512	40,438	16,960	9,181	99,879
5 mo.	406,727	239,345	323,807	191,903	85,920	47,472	.....

Prices of Foundry Metals and Coke

(As of Aug. 24, 1959)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$18.00-18.50
OVEN	
Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearny, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, dsld.	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$62.50	$69.00
Birmingham	62.50	66.50
Buffalo	66.50	67.00
Chester, Pa.	63.50	69.00
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Everett, Mass.	63.00	63.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	63.40	63.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	66.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	66.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 29.25; tin bronze, No. 225, 39.75; No. 245, 33.50; high-leaded tin bronze, No. 305, 33.50; No. 1 yellow, No. 405, 23.75; manganese bronze, No. 421, 26.75.

ALUMINUM: 99 per cent plus primary ingots 24.80. Secondary No. 12 alloy, 23.75–24.00. Deoxidizing grades: No. 1, 24.50; No. 4, 21.50.

MAGNESIUM: 99.8 per cent notched ingots 36.00, f.o.b. Velasco, Tex. (10,000 lb or more).

COPPER: Electrolytic 30.00, delivered Connecticut valley.

ZINC: High grade 12.00, delivered. Die casting alloy No. 3, 14.00; No. 2, 14.50, delivered.

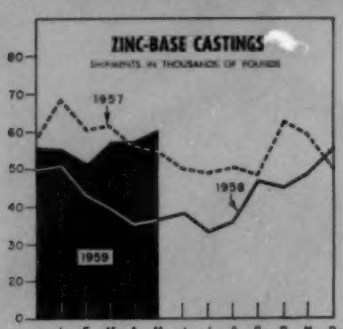
IRON AND STEEL SCRAP

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Clean Auto Cast	Machinery Cast	Malleable	Short Steel Rails
Birmingham	$35.00–36.00	$55.00–56.00	.....	.....	.....	.....	.....
Boston*	**31.00–32.00	**37.00–38.00	.....	.....	**38.00–38.50	.....	.....
Buffalo	33.00–34.00	**44.00–45.00	.....	.....	**48.00–49.00	.....	51.00–52.00
Chicago	37.00–38.00	53.00–54.00	.....	59.00–60.00	59.00–60.00	59.00–60.00	57.00–59.00
Cincinnati*	**35.50–36.50	**47.00–48.00	**43.00–44.00	.....	**53.00–54.00	.....	**55.00–56.00
Cleveland	38.00–39.00	47.00–48.00	38.00–39.00	52.00–53.00	52.00–53.00	65.00–66.00	57.00–59.00
Detroit*	**32.00–33.00	**46.50–47.50	**39.00–40.00	**50.00–51.00	.....	.....	.....
Los Angeles	38.00	**46.50	.....	.....	.....	.....	.....
New York*	30.00–31.00	36.00–37.00	34.00–35.00	.....	.....	.....	.....
Philadelphia	40.00	41.00	43.00	.....	50.00–51.00	67.00–68.00	.....
Pittsburgh	38.00–39.00	47.00–48.00	.....	46.00–47.00	52.00–53.00	.....	57.00–59.00
St. Louis*	33.00	54.00	44.00	56.00	.....	.....	50.00
San Francisco	36.00	47.00	28.00	40.00	40.00	.....	.....
Seattle	35.00	34.00	28.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

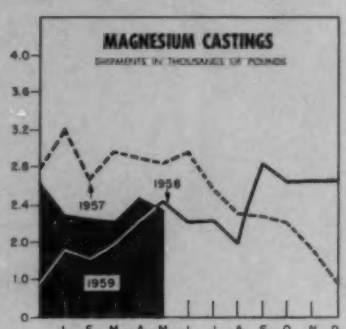
Foundry Statistics



PIG IRON

PRODUCTION**—Net Tons

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1957	2,275,789	3,697,335	7,452,203
1958			
June	121,869	167,192	342,817
6 mo.	748,591	1,159,392	2,287,787
July	123,078	156,582	402,850
Aug.	141,185	145,216	396,511
Sept.	133,556	234,752	416,026
Oct.	146,386	257,111	575,806
Nov.	175,219	257,131	489,095
Dec.	154,007	272,375	429,299
Total[2]	1,622,320	2,448,917	4,954,854
1959			
Jan.	190,392	263,105	479,019
Feb.	121,716	258,250	312,284
Mar.	173,881	341,218	412,533
April	159,950	296 384	427,227
May	198,126	358,087	474,820
June	188,158	346,231	441,052
6 mo.	1,032,223	1,863,724	2,345,774



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1957	549,775	431,509	.....
1958			
May	36,447	24,583	33,428
5 mo.	205,217	133 050	.....
June	38,132	25,993	34,888
July	32,765	22,843	41,534
Aug.	35,860	26,971	45,066
Sept.	47,127	33,520	50,762
Oct.	48,045	36,103	58,154
Nov.	45,431	34,054	57 564
Dec.	55,000	39,768	56,756
Total	508,177	352,302	.....
1959			
Jan.	55,439	38,661	61,192
Feb.	51,368	35,478	57,437
Mar.	57,600	40,700	62,657
Apr.	57,325	40,127	55 916
May	60,658	43,922	62,224
5 mo.	282,390	198,888	.....

CONSUMPTION[1]—Gross Tons

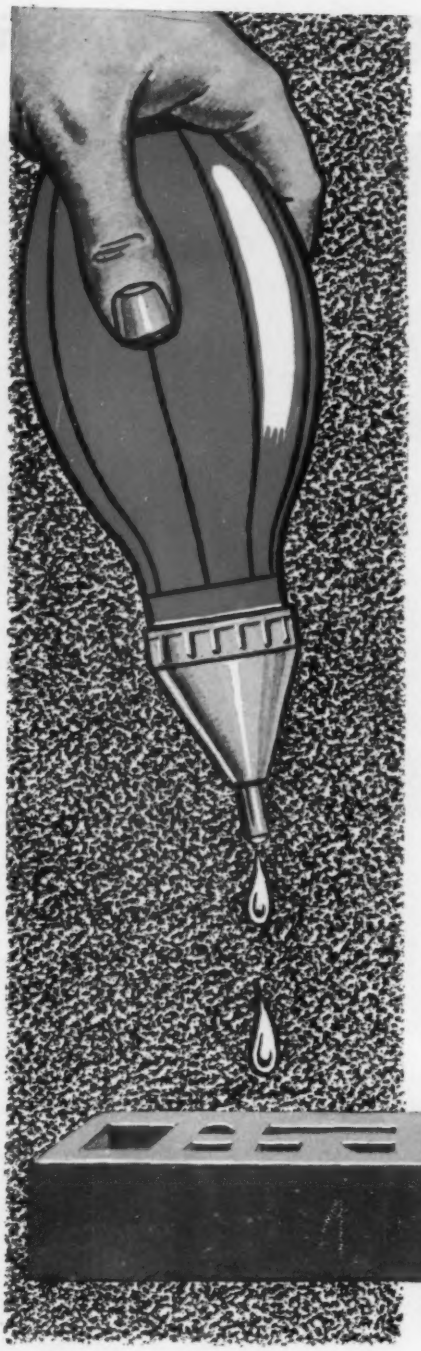
	Cupola	Air	Electric
1957	4,160,991	216,178	246,851
1958			
Mar.	270.214	13,472	8,753
3 mo.	837,948	43,588	30,919
Apr.	262,007	13,975	9,585
May	256,204	12,001	11,764
June	262,883	12,096	15,549
July	239,140	10,550	12,140
Aug.	247,428	13,196	32,309
Sept.	300,173	14,994	27,759
Oct.	300,115	17,393	34,273
Nov.	287,013	14,862	31,397
Dec.	321,741	16,610	25.450
Total	3,314,652	169,267	231,145
1959			
Jan.	321,303	17,113	36,783
Feb.	324,876	17,960	37,414
Mar.	353,985	20,625	42,464
3 mo.	1,000,163	55,698	116,661

MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1957	30,322	28,452	.....
1958			
May	2,422	2,196	5,200
5 mo.	10,296	9,683	.....
June	2,205	1,996	5,515
July	2,200	2,063	6,706
Aug.	1,869	1,808	6,086
Sept.	2,804	2,581	6,063
Oct.	2,827	2,479	5,463
Nov.	2,615	2,523	4,063
Dec.	2,612	2,384	5,115
Total	27,228	25,517	.....
1959			
Jan.	2,291	2,086	5,001
Feb.	2,249	1,905	4,637
Mar.	2,129	1,924	4,465
Apr.	2,456	2,213	4,757
May	2,353	2,094	5,182
5 mo.	11,477	10,312	.....

*Source: U. S. Dept. of Interior, Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.



Drop by Drop... IN 1958

FOUNDRYMEN USED *OVER 200 TONS OF*

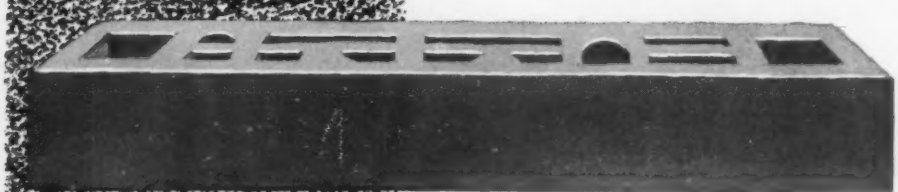
LYQUAGRIP*

READY-TO-USE CORE PASTE

FOR THESE 12 ADVANTAGES

1. Unsurpassed for pasting CO^2 cores
2. Ready mixed, uniform at all times
3. Light colored, odorless, non-corrosive, non-fermenting
4. Dries rapidly at room temperatures
5. Unaffected by normal storage
6. Will not boil or blister
7. No appreciable gas generation
8. Pasted joints are stronger than core
9. Unaffected by mold humidity
10. Extra strong, uses 1/3 to 1/5 as much paste
11. Cores may be reheated without damaging pasted joints
12. Washes off hands and tools easily with warm water

Ask for literature or consult our representative



*Trade Mark Reg.

Whitehead Brothers COMPANY

Established 1841

NEW YORK OFFICE
324 West 23rd St., New York 11, N. Y.

NEW ENGLAND OFFICE
75 Westminster St., Providence 1, R. I.

Manufacturers of:

LYQUAGRIP
Ready-to-use core paste

DOB-IT
Ready-to-use core mudding compound

JOINT-SEAL
Plastic compound for perfect sealing

LYQUAFLOUR
For cleaner surface, better shakeout

LYQUAFACE
The liquid sand grain coating

Circle 579 on Page 53

How WALWORTH

cut snagging costs and increased production!

This was a case where persistence and plain hard work paid off . . . for Bay State . . . and for one of the world's largest valve-makers, The Walworth Company.

It was one of those seemingly simple problems that makes most people throw up their hands in despair: Foundry Superintendent Tom Gowans was dissatisfied with the snagging wheels he'd been using; he wanted to cut costs and boost production, too.

Results varied from disappointing to non-existent until he called in Bay State abrasive specialist Don Kennedy who really went to work. With the help of Bay State's engineering staffs, he came up with a special formulation that combined two different types of abrasives in a combination of grit sizes. Result: A wheel of exceptional toughness with extremely sharp cutting characteristics that breaks down at a uniform rate and eliminates chatter and pounding so that the work-pieces have maximum contact with the wheel. This led to a very worthwhile increase in production speed and, on top of that, there was an 11% price reduction on the wheels themselves.

Like Don Kennedy, the Bay State man in your area is always willing to roll up his sleeves and *work* on a problem. A trained expert himself, he is backed by top-flight research and engineering staffs with wide experience and modern facilities at their command. *Better grinding at lower cost . . . that is their business.*

At left — Section of cleaning room in Walworth's spacious new plant in South Braintree, Mass., where Bay State wheels have set new records for long life, cool cutting and minimum dressing requirements.

At far left — Operator Paul Bombardier grinds slag of bronze bonnet ring using Bay State's free cutting 30 x 3x 12 snagging wheel.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Mass.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh.
Distributors: All principal cities.

Circle 580 on Page 53

S7X211 SPAT

Flare is 7½" long — may be trimmed to fit smaller foot. Chrome leather, ankle length with elastic webbing at top. Two snap fasteners on elastic with two leather adjustable ankle straps. Understrap same material as flare and replaceable.

S1512CL
SPRING LEGGING

Protects lower leg, ankle and instep. Flare is 5½" long. Chrome-tanned cowhide uppers riveted to spring steel frame. No adjustment needed. Easily put on and removed.

S4901CL
LEGGING

Flare 4½" long. Spring steel stay for fast removal — also pull tab, 4 snap fasteners at top. Leather pocket at ankle for positioning steel stay. Fibre shin guards on inside. Instep adjustable strap.

Molten Splashes are no problem when workers

WEAR AO "NO CURL"

Safety Leggings and Spats!

American Optical's "No Curl" flare *stays put* — protects from splash burns in the vulnerable area where the spat (or legging) meets the shoe. Made of a special compound, it stays flat with no sign of *curling*, week after week. What's more, it will lower foot protection costs because leggings and spats with AO "No Curl" offer longer life — up to 400% longer! This revolutionary improvement is available in a full line of AO spats and leggings, three of which are shown. Your nearest AO Safety Products Representative can supply you.

Always insist on AO *Trademarked Safety Products*

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

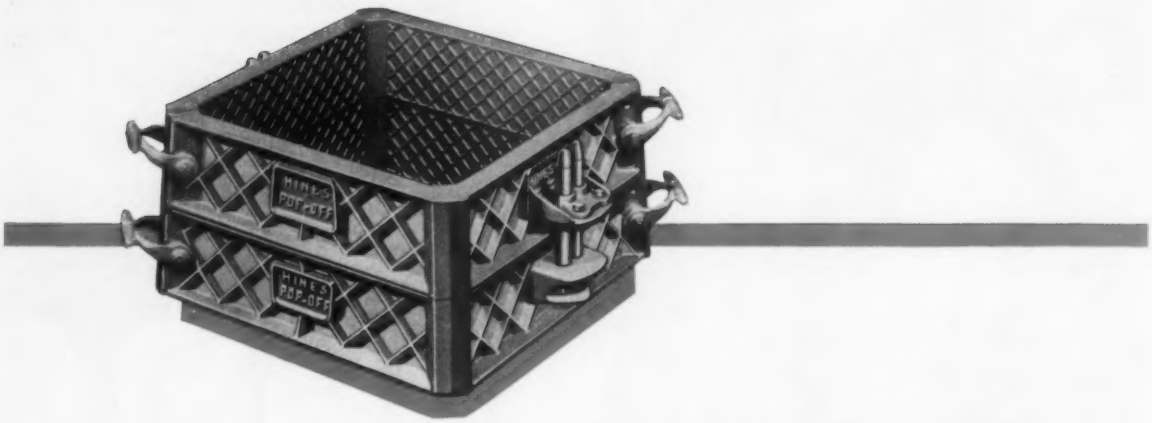
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

Circle 581 on Page 53

HINES STANDARD "POP-OFF" FLASKS

One of many **HINES** *developments contributing to better foundry production*

Perfect lightweight flasks for light casting work — pattern castings, test bars, hand-rammed molds, trade school work and light 10" jolt-squeeze jobs.



- HINES "POP-OFF" flasks are ruggedly built and reinforced with the familiar diagonal ribs.
- No need for hammering to remove the flask from the mold — simply move levers and off it pops!
- Serrations on inside surface of flask eliminate need for sand strips — sand is anchored so firmly there's no possibility of shift from vibration.
- Lengths and widths from 10" to 20". Depths from 7" to 12". Single or double, round, hex or "V" pins, bushings or guides — or pads for your own pins.

WRITE FOR CATALOG FOLDER NO. 204

THE HINES FLASK CO.
3431 WEST 140th STREET • CLEVELAND 11, OHIO

HINES FLASKS

Circle 582 on Page 53

YOU'LL DO A BETTER JOB

with H. V. ADAMS DESIGNED

HIGH EFFICIENCY FOUNDRY TOOLS

"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

with the Double Eight Vibration

Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.

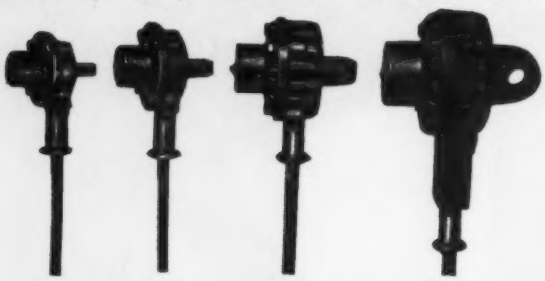
THE "ROTOPLANE" SPEED SIFTER

WILL GIVE YOU

• SPEED • ECONOMY • SAFETY • LONGER LIFE
• GREATER SIFTING CAPACITY

Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

"RED (Devil) ELECTRIC" VIBRATORS



No 1 No. 2 No. 5 No. 9

These hard hitting Adams designed Vibrators have served the foundries for over 30 years. They are provided with a 6 foot 3 wire authorized cable and 3 wire grounded connector which, when connected with our 3 wire grounded Red Electric Knee Switch, automatically grounds the vibrator protecting the worker from shock. The vibrators have passed the U. S. Government code inspection.

Other Foundry Products:

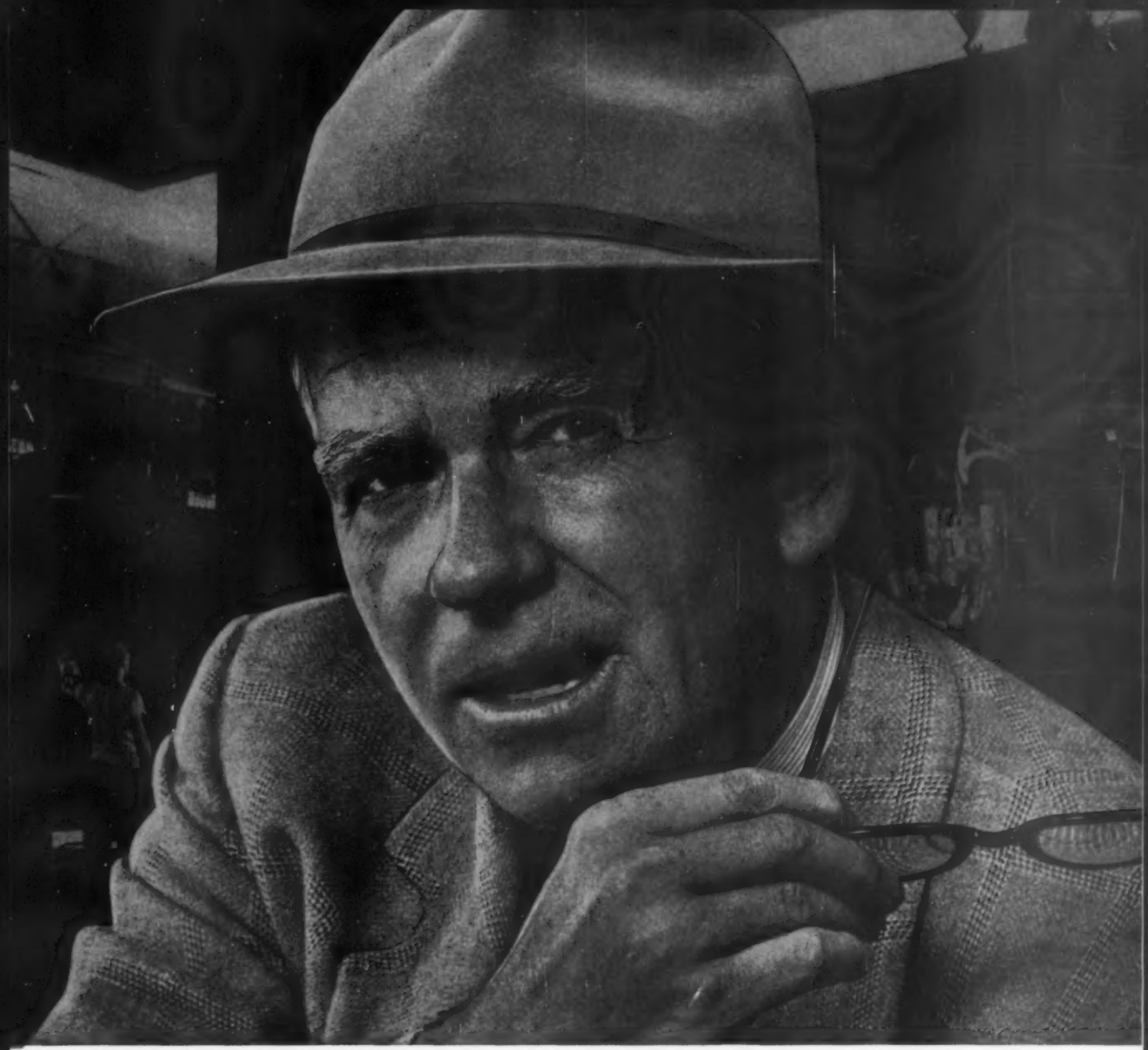
- No. 11 NOISELESS TYPE VIBRATOR
- A-20 ELECTRIC VIBRATOR
- RED ELECTRIC KNEE SWITCHES
- "ROTO" ADJUSTABLE BIN VIBRATOR
- 2 MIN. UNIVERSAL FINENESS TEST SIFTER.
- UNIVERSAL TRIPOD CARRIER

ORDER ALL SIFTERS AND VIBRATORS WITH GROUND WIRE!!

FOUNDRY SUPPLIES MANUFACTURING CO., NOT INC.

2221 Orchard Street - Chicago 14, Illinois

Established 1918 — Cable Address: "Rotoplane Chicago" — H. V. ADAMS, Mgr.



"We use only one chrome—refined chrome"

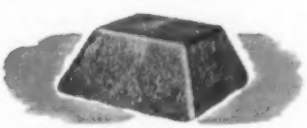
Iron and steel foundry operators are cutting chromium costs by using ELECTROMET'S new low-cost refined chrome for all high-carbon chromium additions. Inventory, handling, and storage are greatly simplified by stocking only this one high-carbon chromium alloy. It is ideal for use as:

- **A charge material for basic-melted stainless steel.**
- **Final additions for alloy steel castings.**
- **Cupola or ladle additions for cast iron.**

Refined chrome combines the economy of regular charge chrome with the maximum cleanliness and low residual element content of conventional high-carbon ferrochrome.

For facts on how refined chrome can reduce your costs, contact your Union Carbide Metals representative.

UNION CARBIDE METALS COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.



Convenient 20- and 40- pound pigs of refined chrome are magnetic, allowing easy handling with an electromagnet. Crushed sizes are available for ladle additions.

UNION CARBIDE METALS

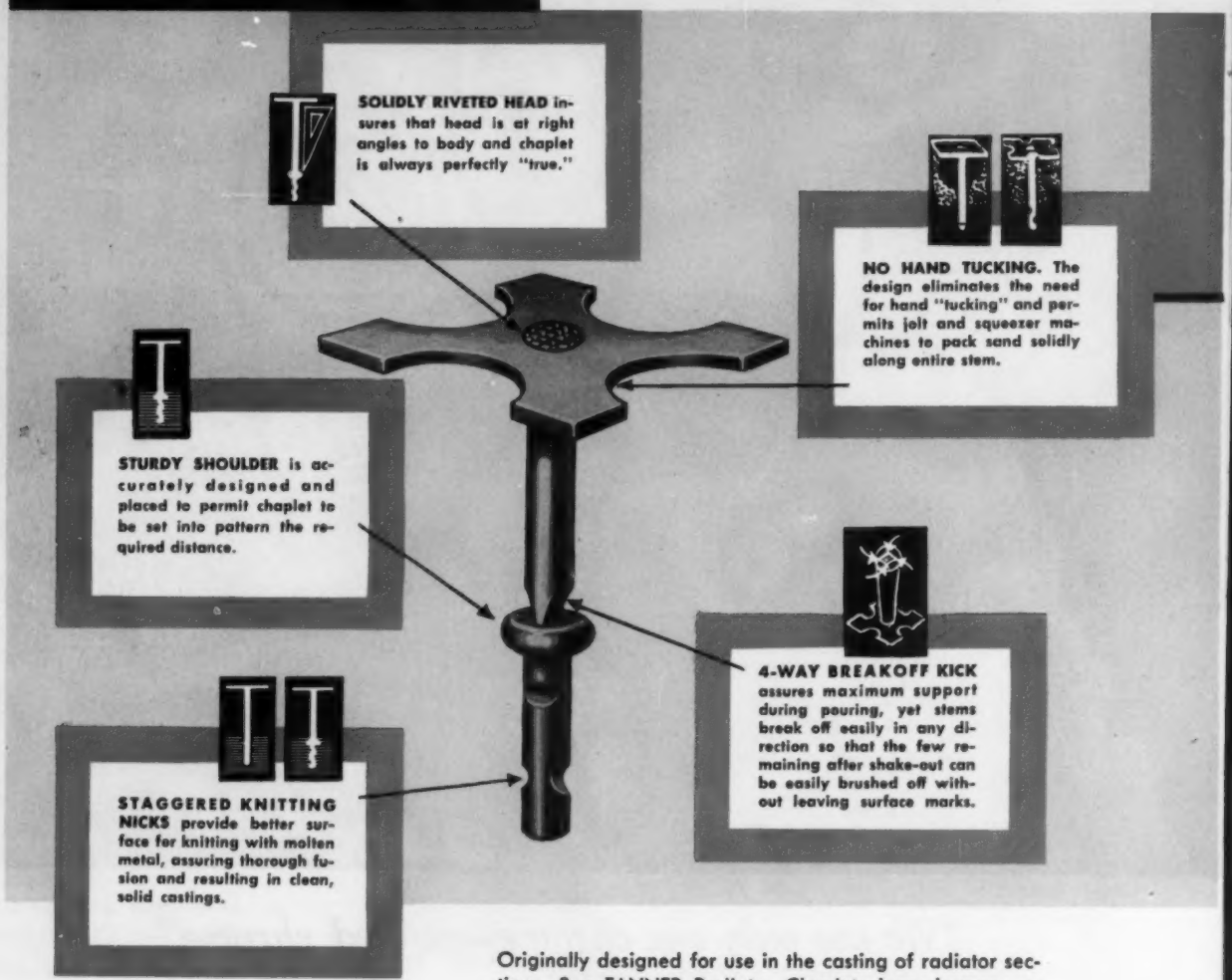
***Electromet** Brand Ferroalloys and other Metallurgical Products*

The terms "Electromet" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

Circle 584 on Page 53

fine FANNER RADIATOR CHAPLETS

. . . made in a wide range of types

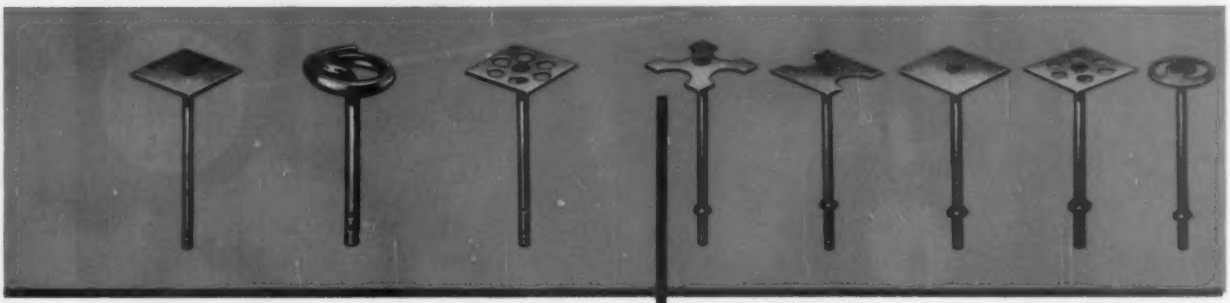

SOLIDLY RIVETED HEAD insures that head is at right angles to body and chaplet is always perfectly "true."
NO HAND TUCKING. The design eliminates the need for hand "tucking" and permits jolt and squeezer machines to pack sand solidly along entire stem.
STURDY SHOULDER is accurately designed and placed to permit chaplet to be set into pattern the required distance.
4-WAY BREAKOFF KICK assures maximum support during pouring, yet stems break off easily in any direction so that the few remaining after shake-out can be easily brushed off without leaving surface marks.
STAGGERED KNITTING NICKS provide better surface for knitting with molten metal, assuring thorough fusion and resulting in clean, solid castings.

Originally designed for use in the casting of radiator sections, fine FANNER Radiator Chaplets have become so popular that they are now made in eight different types. This is an example of FANNER's policy to provide exactly the right chaplet for every application. Their superior construction gives positive assurance of better casting production at lower overall costs.

TYPICAL APPLICATIONS

prove that 8 heads are better than one

that are ideal for LIGHT CORE WORK



STRAIGHT TYPES

PLATE HEAD RADIATOR CHAPLETS

Gauge of Stem — 6 to 16 gauge
Length of Stem — 1" and under
Size of Head — 3/8" to 1 1/4"

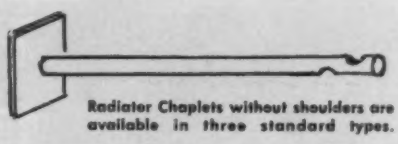
WIRE COIL RADIATOR CHAPLETS

Gauge of Stem — 8 to 16 gauge
Length of Stem — 1" and under

SHOULDER TYPES

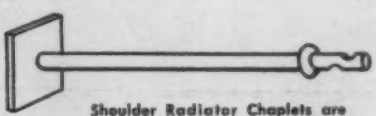
Gauge of Stem — 13 to 16 gauge
Length of Stem — 1" and under to 3"
Size of Head — 3/8" to 1 1/4"

Other weights and sizes available upon application

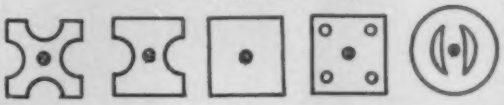


Radiator Chaplets without shoulders are available in three standard types.

Square Head | Coil Head | Perforated Head



Shoulder Radiator Chaplets are available in five standard types.



Cross Head | "H" Type Head | Square Head | Perforated Head | Crescent Head

Fine FANNER Radiator Chaplets are designed for use with the side of the largest bearing surface against the green sand. They will readily support up to five pounds per square inch load. Their special heads, the staggered knitting nicks, the deep "V" break-off nick and solidly riveted heads provide production advantages that result in clean, sound castings in less time and with less effort!

Write for complete chaplet catalog.

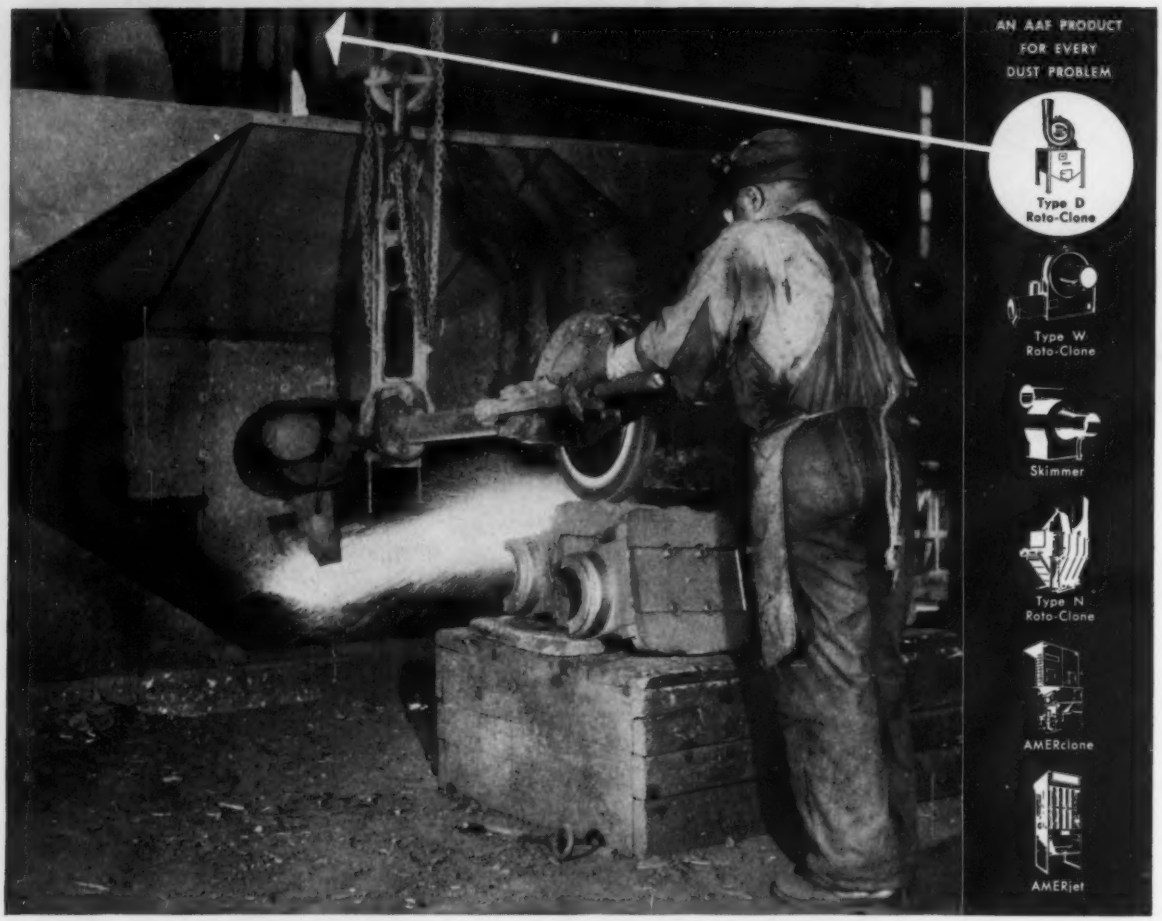
THE FANNER MANUFACTURING CO.

Designers and manufacturers of fine FANNER CHAPLETS AND CHILLS

BROOKSIDE PARK **CLEVELAND 9, OHIO**

Circle 585 on Page 53

GRINDING



AAF Type D ROTO-CLONE takes the grime out of grinding

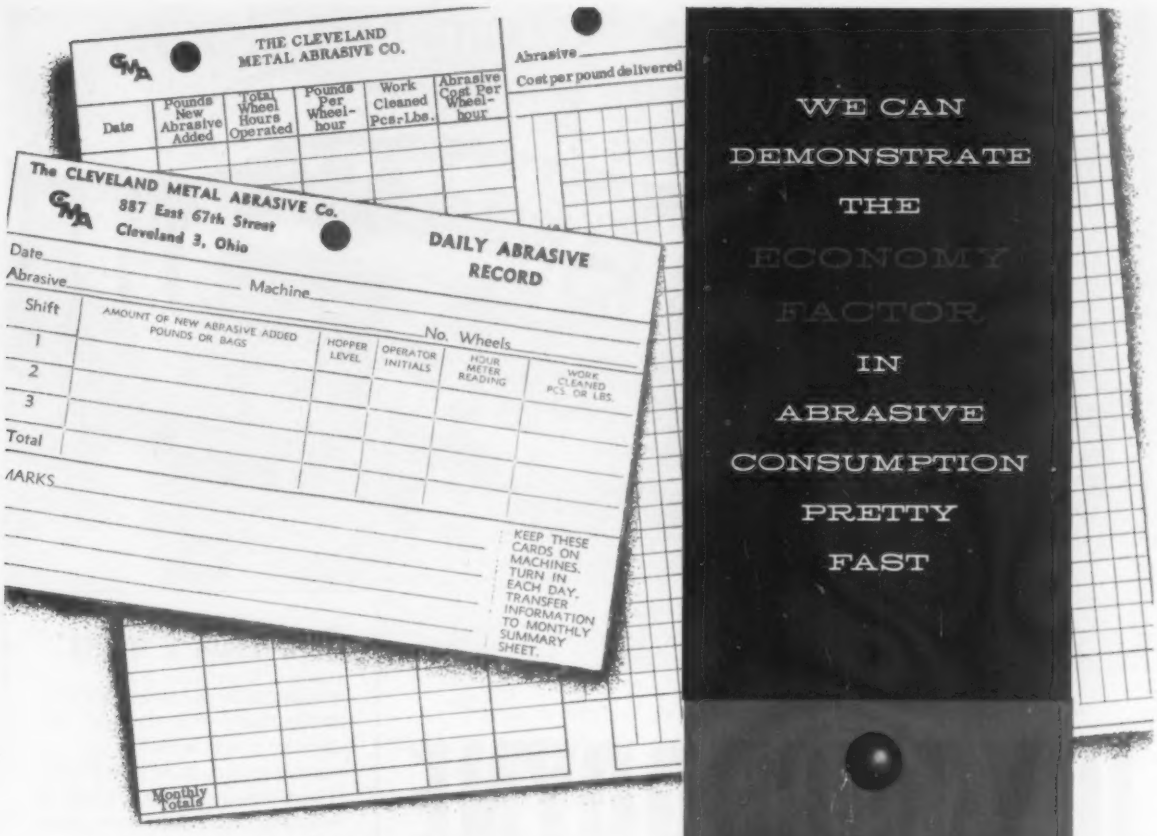
● Foundry grinding dust is the favorite diet of AAF's dry-collecting dynamic precipitator, the Type D ROTO-CLONE. Whether the grinder is a swing frame, snag or portable, the dust meets the same fate—instant extinction. Result: lower maintenance costs, better employee and community relations.

The Type D draws in the dust-laden air, delivers the collected material to the storage hopper and exhausts the clean air—all in a single operation with only one moving part: the impeller. Exhauster, separator and storage hopper are combined in a compact, self-contained unit.

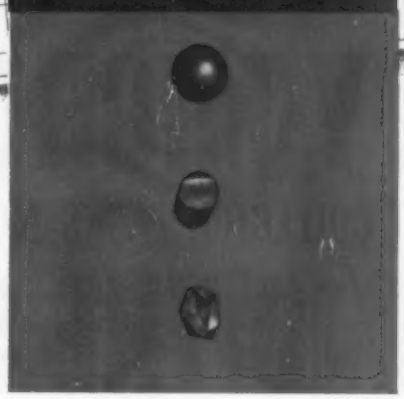
AAF's complete line of dust control equipment was application-developed, now challenges *any* foundry dust problem. For your grinding dust problem, get in touch with your local American Air Filter representative or write direct for Type D ROTO-CLONE Bulletin 272. Address Mr. Robert Moore, American Air Filter Company, Inc., 266 Central Avenue, Louisville, Kentucky.

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

Circle 586 on Page 53



WE CAN DEMONSTRATE THE ECONOMY FACTOR IN ABRASIVE CONSUMPTION PRETTY FAST



Simple arithmetic and common sense establish the pattern. It's simply a matter of making high quality, *long-lasting* abrasives. The less you use, the more money you save. Take Cleveland High-strength "A" iron shot and grit. Greater abrasive life and decreased machine maintenance costs offset any minor increase in initial costs. Bargain prices cut no ice . . . ever.

Prove to yourself the savings you get from this, and other, Cleveland Metal Abrasives. Write—and ask for our new abrasive cost system, which our engineers can quickly establish for each machine, at no cost to you.

Also write us today for more information, together with new catalog No. 159, or call our nearest representative.

CLEVELAND is the name and the place for PERSUASIVE ABRASIVES

1. Realsteel Shot and Grit	2. Pearlitic Malleable	3. Normalized	
4. "A" Iron	5. Hi-Strength "B"	6. Chilled Iron	7. Cut Wire

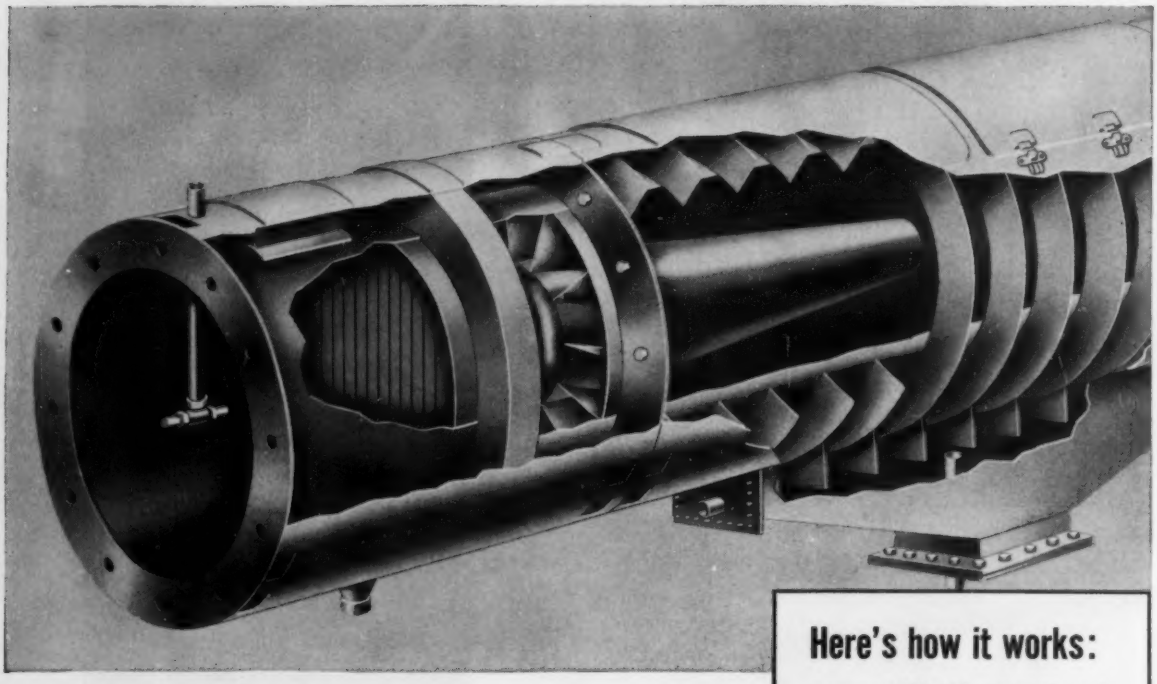
the CLEVELAND metal abrasive company

GENERAL OFFICE: 888 East 67th Street • Cleveland 3, Ohio • PLANTS AT Howell, Michigan; Toledo; Cleveland

World's Largest Production Capacity

Teletype: CV 901

Circle 587 on Page 53



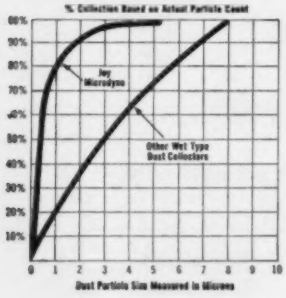
Here's how it works:

a spray of liquid enters the collector along with the dust. An impingement screen helps to encase each particle with liquid. Then fixed vanes impart a whirling motion to the wet, dust laden air. Moisture and dust particles are thrown to the sides by centrifugal force and drain into a sump.

The liquid used may be water, oil or solvents, depending on the material being collected.

JOY MICRODYNE®

DUST COLLECTOR PACKS MORE EFFICIENCY IN 1/10 THE SPACE



By combining two proved principles of dust collection, the Joy Microdyne collects over 99% by weight of dust particles 5 microns and larger; 92% of 2-micron dust. This means cleaner air.

Because of its unique design the Joy Microdyne is extremely compact . . . 1/10 to 1/20 the size of conventional wet collectors. For example: an 8000 cfm unit is only 26″ in diameter, 130″ long. This means lower initial cost and easier installation . . . in fact, the Joy Microdyne can be installed as part of existing ductwork.

Let us know about your dust collecting problems by describing the type of dust, approximate particle size and cfm required—and write for free bulletin 317-13.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

WBW 17976-317

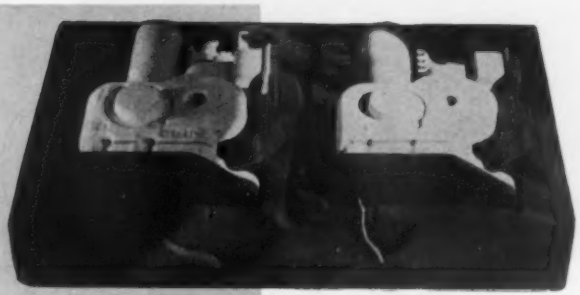
Circle 588 on Page 53

CONTROLLED QUALITY CASTING FINISH

BEGINS WITH

QUALITY CONTROLLED

DELTA CORE AND MOLD WASHES



DELTA FOUNDRY PRODUCTS

•

CORE AND MOLD WASHES
Plastic-type and powder-type for steel, malleable, gray iron and non-ferrous castings.

•

PARTINGS
Powder Type, Liquid Type, Concentrate.

•

SPECIFICATION CORE OILS
to meet every core making and baking requirement.

•

CORE RESINS

•

CORE BINDERS

•

SILICATE-COLD PROCESS BINDERS

•

MOLD SPRAY BINDERS

•

MUDDING AND PATCHING COMPOUNDS

•

MILL COATINGS

•

SPECIALTY PRODUCTS
Chill Oil • Sand Conditioning Oil • Sand Release Agent • Permi-Bond • Core Adhesives • No-Vein Compound • Mold Seal Compounds • and many others.

Quality control, at Delta, starts with the raw materials as they are received at the plant. Before permission is given to unload, samples are sent to the laboratory for approval.

Intervals and techniques of sampling are important in both raw materials and manufacturing processes. Any deviation from approved methods could confuse the most exacting quality control operation.

Means and mechanisms for the operation and regulation of equipment . . . for the control of time and temperature factors . . . are often critical considerations in the control of product quality. Variations are restricted to prescribed tolerances which are constantly supervised by quality control personnel.

Delta's control of product quality is the user's assurance of product uniformity. And the product uniformity of Delta Products is a critical factor in the quality control of casting finish.

TEAMWORK . . . IN FOUNDRY SCIENCE AND CHEMICAL RESEARCH

OUR 26TH YEAR

DELTA

Get the facts . . . Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA OIL PRODUCTS CORP. | **MILWAUKEE 9, WISCONSIN**

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

Circle 589 on Page 53

These "passengers" pay at the end of the line

As conveyor line "passengers," foundry molds are delicate and cranky. They pay off well in perfect castings at shake-out, but only when the ride has been super-smooth. That's why Logan pouring line conveyors are engineered to such close tolerances. Your Logan Foundry Conveyor System is carefully designed and built, line by line, for each of the loads it must handle, the jobs it has to do. Whatever your scale of operation, and whether your castings are in the multi-ton class or small parts, your Logan Conveyor gives you the tough dependability you need at the lowest feasible cost.

Your layout and specifications are done by one of the best conveyor engineers in the business—the hand-picked, extensively trained Logan field engineer in your area. He focuses the whole of Logan's two generations of experience squarely on your needs. "The Man from Logan" sees your installation through to smooth operation. If you have a conveyor problem, call or write us for a visit from this talented conveyor man.

"The Man from Logan"

Logan Conveyors

LOGAN CO., 580 CABEL ST., LOUISVILLE 6, KY.

Circle 590 on Page 53

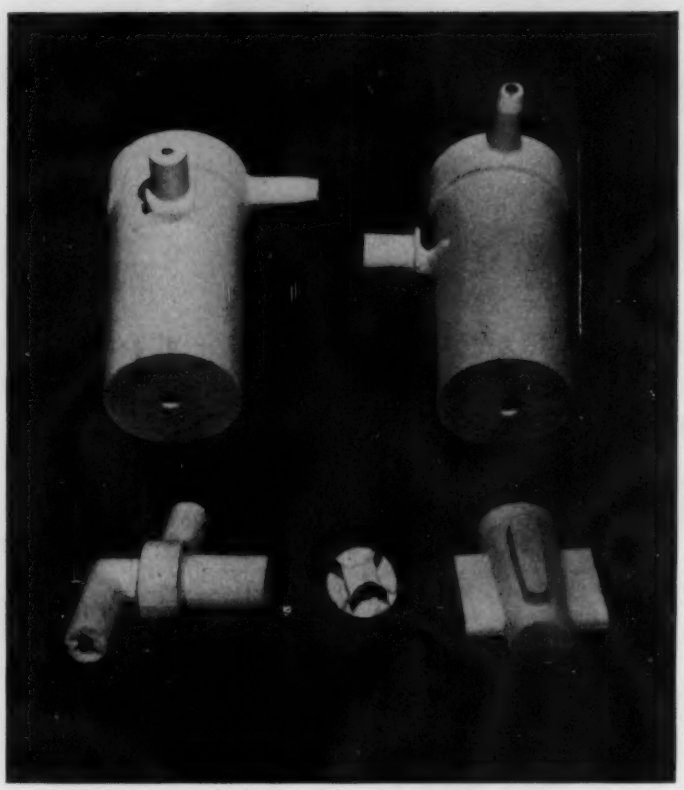
Order KOPPERS Premium Foundry Coke

Premium quality foundry coke! That's exactly what Koppers delivers car-after-car. Made from the highest quality West Virginia coals, scientifically blended and baked the right length of time, Koppers Premium Foundry Coke is absolutely *uniform* in *size, strength, structure* and *chemical analysis*. With its higher carbon content, Koppers Coke enables the foundryman to maintain a higher temperature range, thus increasing the the cleanliness of the iron. This in turn, helps reduce fuel consumption and means lower operating costs all around. Next time *order* Koppers Premium Foundry Coke. Available anywhere in the U.S. or Canada in sizes to meet your needs. Koppers Company, Inc., Pittsburgh, Pa.

WE CHECK EACH DAY'S RUN to make certain you get foundry coke of the exact size and chemistry that is most efficient for the job. Analyses are available to your foundry on request.

Circle 591 on Page 53

Get Lower Cost Castings...
Closer Tolerances and Smoother Finish



Typical cores produced by the Cardox CO_2 core hardening process

CARDOX® CO_2
SEMI-PRECISION
MOLDING PROCESS

This latest Cardox improvement in the CO_2 core hardening process can help you to produce castings with closer dimensional accuracy and smoother finish than has been possible with conventional methods. Providing full hardening of cores and molds in 15 to 30 seconds, it also eliminates the cost and space of core dryers and core storage, and enables faster production set-ups.

Combining the best features of shell molding with the proven CO_2 hardening process, this new advance is substantially reducing costs in many ferrous and non-ferrous foundries. It is increasing production with little or no capital outlay for new equipment. No major change in production methods is required.

Write today for reprints of the illustrated case history, "CO_2 Core Hardening Enables Two Pittsburgh Foundries to Improve Precision, Speed Production".

To Help You Make Best Use of the
CARDOX SEMI-PRECISION MOLDING PROCESS
CARDOX® CO_2
AVAILABLE IN ANY FORM

Bulk Liquid Carbon Dioxide — The storage method originated and developed by Cardox. More Cardox Storage Units are used in industry than any other make. Storage Units are supplied without capital investment when user requirements warrant it, on a user contract basis . . . **Also CO_2 cylinder gas, dry ice and converters.**

Cardox assures you of carbon dioxide delivered when you need it, where you need it, how you need it. Depots and warehouses in 65 convenient locations, with nationwide delivery by Cardox-owned transport trucks, and railway tank cars.

WHEREVER YOU ARE YOU ARE CLOSE TO CARDOX, 65 CO_2 supply depots and warehouses.

CARDOX DIVISION OF CHEMETRON CORPORATION • Dept. 419
840 N. Michigan Avenue, Chicago 11, Illinois

CHEMETRON

REGIONAL OFFICES: Jersey City, N. J. 7th & Provost Sts. · Memphis, Tenn. 748 Mississippi St. · Detroit, Michigan 1723 W. Lafayette Blvd. · Chicago 9, Illinois 43rd & Marshfield Ave. · St. Louis, Missouri 3123 N. Broadway · Fort Worth, Texas 825 N. Calhoun St. · Los Angeles, Calif. 151 North Avenue 19

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- For more information on anything advertised in this issue
- For further data on products described in the Equipment and Supplies section (Page 127)
- To get copies of publications listed in the Literature for Foundrymen section (Page 186)
- To request extra copies of editorial articles

FOUNDRY SEPTEMBER 1959

401	431	461	491	521	551	581	611	641	671	701	731	761	791	821	851
402	432	462	492	522	552	582	612	642	672	702	732	762	792	822	852
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404	434	464	494	524	554	584	614	644	674	704	734	764	794	824	854
405	435	465	495	525	555	585	615	645	675	705	735	765	795	825	855
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407	437	467	497	527	557	587	617	647	677	707	737	767	797	827	857
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417	447	477	507	537	567	597	627	657	687	717	747	777	807	837	867
418	448	478	508	538	568	598	628	658	688	718	748	778	808	838	868
419	449	479	509	539	569	599	629	659	689	719	749	779	809	839	869
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426	456	486	516	546	576	606	636	666	696	726	756	786	816	846	876
427	457	487	517	547	577	607	637	667	697	727	757	787	817	847	877
428	458	488	518	548	578	608	638	668	698	728	758	788	818	848	878
429	459	489	519	549	579	609	639	669	699	729	759	789	819	849	879
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402	432	462	492	522	552	582	612	642	672	702	732	762	792	822	852
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419	449	479	509	539	569	599	629	659	689	719	749	779	809	839	869
420	450	480	510	540	570	600	630	660	690	720	750	780	810	840	870
421	451	481	511	541	571	601	631	661	691	721	751	781	811	841	871
422	452	482	512	542	572	602	632	662	692	722	752	782	812	842	872
423	453	483	513	543	573	603	633	663	693	723	753	783	813	843	873
424	454	484	514	544	574	604	634	664	694	724	754	784	814	844	874
425	455	485	515	545	575	605	635	665	695	725	755	785	815	845	875
426	456	486	516	546	576	606	636	666	696	726	756	786	816	846	876
427	457	487	517	547	577	607	637	667	697	727	757	787	817	847	877
428	458	488	518	548	578	608	638	668	698	728	758	788	818	848	878
429	459	489	519	549	579	609	639	669	699	729	759	789	819	849	879
430	460	490	520	550	580	610	640	670	700	730	760	790	820	850	880

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FOUNDRY

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FIRST CLASS
Permit No. 36
CLEVELAND, OHIO

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed in the United States
—POSTAGE WILL BE PAID BY—

FOUNDRY
Penton Building
Cleveland 13, Ohio

Reader's Service Dept.

FIRST CLASS
Permit No. 36
CLEVELAND, OHIO

BUSINESS REPLY MAIL
No Postage Stamp Necessary If Mailed in the United States
—POSTAGE WILL BE PAID BY—

FOUNDRY
Penton Building
Cleveland 13, Ohio

Reader's Service Dept.

PACIFIC METALS CO., LTD.
STEEL SALES CORPORATION
WILLIAMS & COMPANY, INC.
J. M. TULL METAL & SUPPLY CO., INC.
WHITEHEAD METALS, INC.
There when you need it...

...VCA Distributor Service — When you're in a hurry for warehouse quantities of alloys, there's a VCA distributor near you who can meet your needs completely — and *fast!* In warehouses all across the country, adequate stocks of Vancoram products are on call. Next time get the big benefits of VCA service, plus the bonus benefits of Vancoram *extra* quality! Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N. Y. • Chicago • Cleveland • Detroit • Pittsburgh

Vancoram products are distributed by:

PACIFIC METALS CO., LTD.
San Francisco, Los Angeles, San Diego, Phoenix, Salt Lake City

J. M. TULL METAL & SUPPLY CO., INC.
Atlanta, Ga., Jacksonville, Miami, Tampa, Fla., Birmingham, Ala., Greenville, S. C.

STEEL SALES CORP.
Chicago, Detroit, Milwaukee, Indianapolis, Grand Rapids, Minneapolis, St. Louis, Kansas City, Mo.

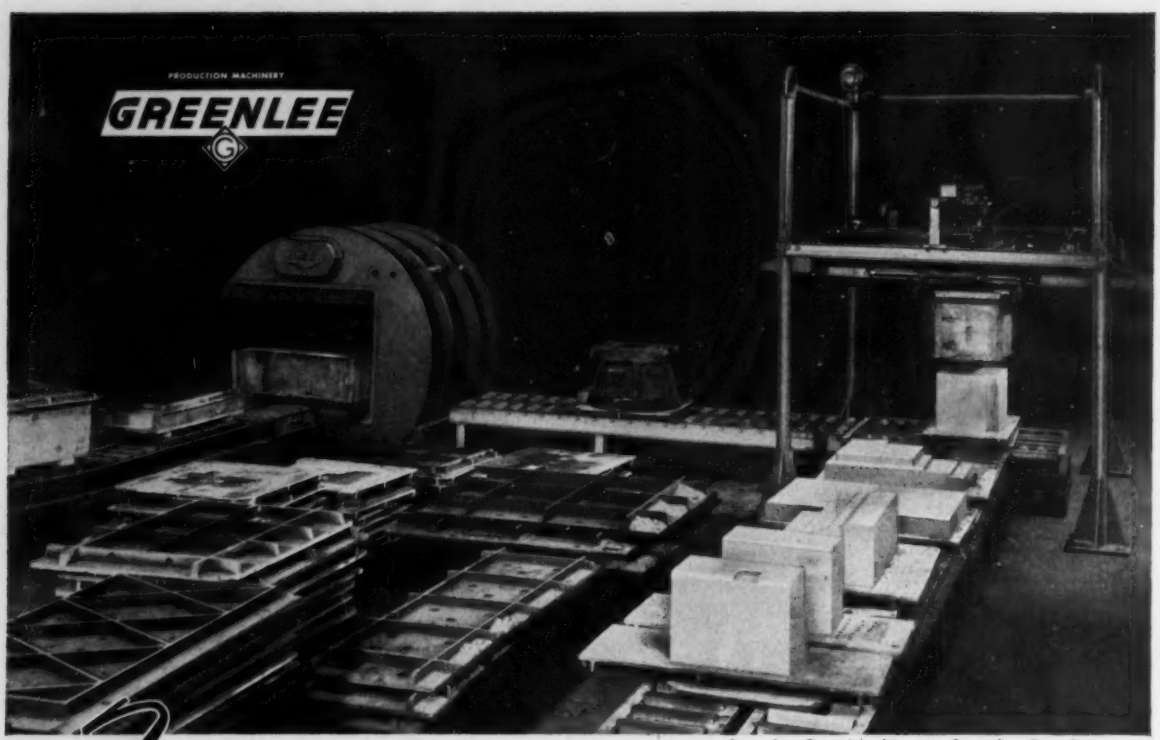
WHITEHEAD METALS, INC.
New York City, Buffalo, Syracuse, Albany, Schenectady, Rochester, Philadelphia, Lancaster, Allentown, Baltimore, Harrison, N. J., Windsor, Conn., Cambridge, Mass., Richmond, Va.

WILLIAMS & COMPANY, INC.
Pittsburgh, Cleveland, Cincinnati
Columbus, Toledo

VANCORAM

VANADIUM CORPORATION OF AMERICA

Circle 593 on Page 53



Greenlee Core Machines in Greenlee Foundry

Foundrymen: Mechanize your Core Line Production with GREENLEE Core Rollover and Draw Machines

. . . Increase daily core production
. . . Reduce box and core damage
. . . Permit use of lighter, less expensive core boxes

Greenlee Core Rollover and Draw Machines pay large dividends in high speed, economical core line production. These machines are capable of handling 50 cores per hour. Compare your present method with this production time! Greenlee Core Rollover and Draw Machines provide the flexibility needed for large and small core production.

Standardization of core box sizes is unnecessary . . . use your present boxes. Lighter, inexpensive core boxes can be used because hammering, crane handling and log chain damage is eliminated. Greenlee Core Machines can help you produce better cores faster, more economically.

CORE ROLLOVER MACHINE
Clamp, rollover and roll back cycle time is 45 seconds.

CORE DRAW MACHINE
Positions, clamps, vibrates, draws core boxes to 32" deep in 80 seconds.

WRITE FOR BULLETIN F-101 — YOU'LL GET COMPLETE DETAILS ON GREENLEE CORE MACHINES

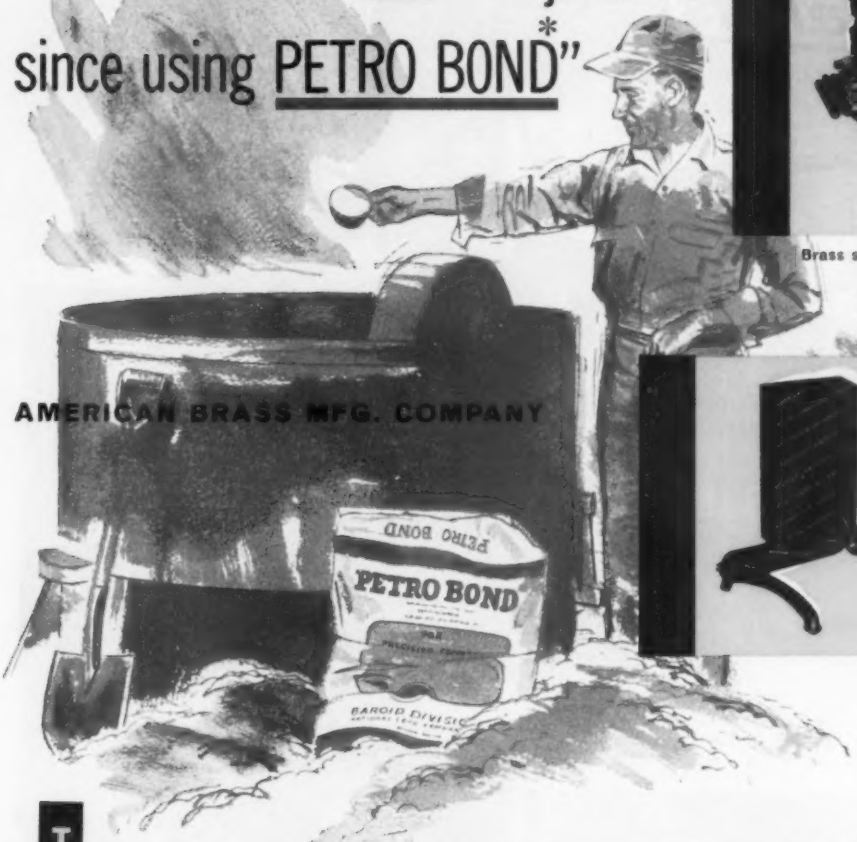
Machines designed with the future in mind.

GREENLEE BROS. & CO.

1700 MASON AVE.
ROCKFORD, ILLINOIS

..."less than 2% rejects since using PETRO BOND*"

Brass shakeouts of brass plumbing fixtures.



Brass plumbing fixtures in finish.

The American Brass Manufacturing Company of Cleveland, Ohio were able to lower their percentage of casting rejects to less than 2% . . . when they used PETRO BOND as their formulated sand-bonding agent. This is an enviable net end result . . . one desired by many foundrymen.

YOU too can obtain these same results . . . once PETRO BOND becomes your sand-bonding agent.

Castings made with PETRO BOND are better because they provide smoother finish . . . more faithful reproduction of the pattern . . . sounder castings . . . closer tolerances . . . denser surface . . . plus less porosity.

PETRO BOND produces precision castings with conventional foundry equipment. Let PETRO BOND prove its cost-cutting advantages to you. It will cost you nothing to find out.

*Registered Trademark, National Lead Company

BAROID CHEMICALS, INC.

A SUBSIDIARY OF NATIONAL LEAD COMPANY

5978

1809 SOUTH COAST BLDG. HOUSTON 2, TEXAS

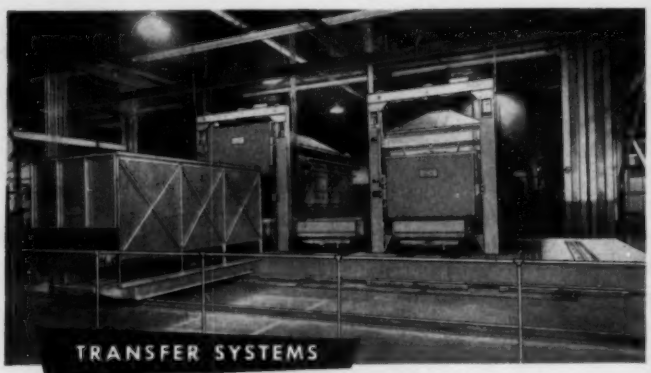
PETRO BOND is available from dealers listed herewith:

ALABAMA—Foundry Service Co., Birmingham. **CALIFORNIA**—Independent Foundry Supply Co., Los Angeles—Industrial & Foundry Supply Co., Oakland 7. **ILLINOIS**—American Steel & Supply Co., Chicago 28—Western Materials Co., Chicago 3—Mathens Company, Moline—John P. Moninger, Elmwood Park. **INDIANA**—Steelman Sales Co., Munster. **MASSACHUSETTS**—Klien-Farris Co., Inc., Boston 11. **MICHIGAN**—Foundries Materials Co., Coldwater—Foundries Materials Co., Detroit—Warner R. Thompson Co., Detroit. **MINNESOTA**—Smith-Sharpe Co., Minneapolis. **MISSOURI**—Walter A. Zeis, Webster Groves. **NEW JERSEY**—Asbury Graphite Mills, Inc., Asbury. **NEW YORK**—Combined Supply & Equipment Co., Buffalo—Geo. W. Bryant Core Sands, Inc., McConnellsville. **OHIO**—The Buckeye Products Co., Cincinnati 16—The Hoffman Foundry Supply Co., Cleveland 13. **OREGON**—La Grand Industrial Supply Co., Portland 1. **PENNSYLVANIA**—Pennsylvania Foundry Supply & Sand Co., Philadelphia 24. **TENNESSEE**—Robbins & Bohr, Chattanooga 2. **TEXAS**—Sinclair-Brandt Equipment and Supply Company, Houston. **VIRGINIA**—Asher-Moore Company, Richmond 25. **WASHINGTON**—Carl F. Miller & Co., Seattle 4—Pearson & Smith, Inc., Spokane. **WISCONSIN**—Interstate Supply & Equipment Co., Milwaukee 4. **CANADA**—Canadian Foundry Supplies & Equipment Ltd., Montreal 30, Quebec (Main Office) and Toronto 14, Ontario.

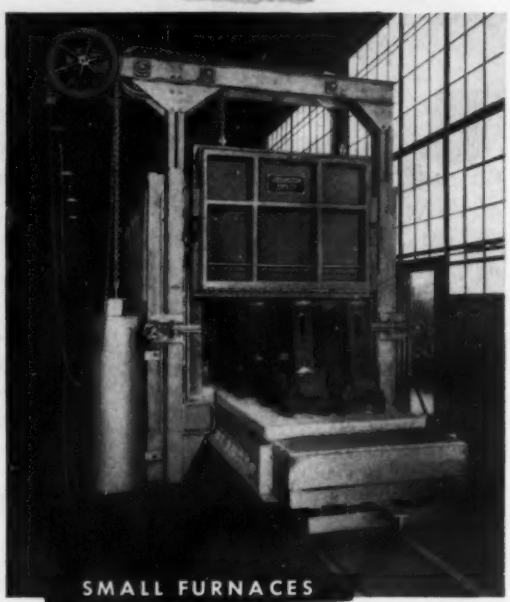
Circle 595 on Page 53

CAR BOTTOM FURNACE *Specialists!*

JOHNSTON can provide Car Bottom Furnaces to meet most requirements. The furnace shown above is twice the length of a boxcar and is used for heating of large welded units and castings. They are designed for oil or gas firing in either direct or recirculating types and for single or double end operation.



Designed for use where maximum production is demanded. Transfer systems are available with remote controls for complete operation from one point, complete with insulated transfer cars and hooded cooling stations.



The mainstay for years in heat treating departments. Available with complete program control, electric fluid drive car puller and door hoist mechanisms to provide for maximum in trouble free operation. All JOHNSTON car type furnaces have the proven mechanical seal between car and furnace.

WRITE FOR BULLETIN F240 ON JOHNSTON CAR BOTTOM FURNACES

SAFETY THE JOHNSTON LINE DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

Engineers and Manufacturers of Industrial Heating Equipment

MELTING FURNACES • HEAT TREATING FURNACES • HEATING TORCHES • LADLE HEATERS • GAS & OIL BURNERS • BLOWERS

...and rest assured!

You can lean back and relax when Standard's famous BLACKHAWK foundry sand is working for you. That's because you know you are using the finest silica you can possibly buy; that your foundry products will be top quality; that they will require less finishing, less clean-up time.

BLACKHAWK is the name, and the Standard distributor in your area is the man who can supply you.

Shipping facilities via two of the nation's trunk line railroads.

STANDARD
Silica Company
OTTAWA • ILLINOIS

Silica Center of the World

Circle 597 on Page 53

PURECO CO_2 QUICK-HARDENS LARGEST PROPELLER MOLD

19½-foot, 41,000-pound propeller cast in CO_2 hardened mold by a West Coast shipyard. No baking. No buckling. Sand re-usable. Machine shop costs reduced.

This is the largest propeller ever cast in the United States from a sand mold quick-hardened with Pureco CO_2.

The CO_2 process was employed, hardening the mold within minutes . . . compared to a former high-cost, baking process requiring up to 75 hours.

The Pureco equipment needed is simple and low in cost.

Your Pureco representative will be glad to arrange for a demonstration of the CO_2 process in your plant, or supply you with further information at no cost or obligation to you.

PURECO CO_2

Pure Carbonic Company

A Division of Air Reduction Company, Incorporated

150 EAST 42ND STREET, NEW YORK 17, N. Y.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

Circle 598 on Page 53

Save coke . . . melt hotter iron . . . Hot Blast will do this for you! Whiting Hot Blast gets more heat out of coke . . . ignites it faster. Tuyeres keep clean and unobstructed, provide better control of melt. Oxidizing zone is reduced and oxidation losses are cut. And less coke means less sulphur in the melt!

Hot Blast more than pays for itself in *coke savings alone!* Better quality, hotter iron are bonus benefits. Investigate Hot Blast now. Call in a Whiting Foundry Engineer!

FREE BOOKLET . . . Gives sharp insight into Hot Blast advantages; describes operation of two major types. Write for Bulletin FO-3. *Whiting Corporation, 15607 Lathrop Avenue, Harvey, Illinois*

75th Year

COST-SAVING EQUIPMENT...THE WAY TO HIGHER PROFITS

FOUNDRY EQUIPMENT

WHITING

MANUFACTURERS OF CRANES; TRAMBEAM HANDLING SYSTEMS; TRACKMOBILES; FOUNDRY, RAILROAD, AND SWENSON CHEMICAL EQUIPMENT

Circle 599 on Page 53

BROADEN

YOUR CASTINGS MARKETS

with the Magnaflux 4-Point Program that helps you sell more castings at lower cost–"tested" for the best on-the-job performance

Ferrous and nonferrous including the increasingly popular aluminum, too.

Here's What the Magnaflux 4-Point Program is:

1. Improve design for casting

With Stresscoat brittle coatings, make it easy for your customer to design *good* castings. You get "conversions," and hold present accounts with lighter castings that are easier to pour for more foundry profit at lower customer cost!

2. Establish useful standards

Make useful quality levels easier for you, by helping your customer specify critical tests only in areas needed! After Stresscoat work you know the few areas on the part that carry high stress, and the many areas where minor defects make no difference.

Base testing standards only on the need, to assure useful and reliable castings, — but not perfection. This applies to both ferrous and non-ferrous castings.

3. Gain better foundry control

With Magnaflux Test Systems you have a continuous check available from pilot casting to final production. You spot trouble fast and correct its cause. Finding pouring problems or the source of handling cracks saves the time and money wasted in processing castings destined for reject. You get more production, with less trouble!

4. Promote the reputation and acceptance of <u>your</u> castings

"Tested by Magnaflux" certifies that your castings are fully reliable for the service intended. This recognition helps create new uses for your castings, and more foundry customers.

The more you prove out the best on-the-job casting performance the more sales and higher profits you'll gain. Ask our Magnaflux Field Engineer to give you all the facts on our 4-point Program and how it helps you tap new markets. Write or call for a meeting. No obligation, of course.

These Magnaflux "Test" Tools will help you get them

MAGNAFLUX-MAGNAGLO
for magnetic metals.
Prices from $195.

ZYGLO
for nonferrous metals, stainless. Complete kits from $125.

STRESSCOAT
Shows where and how stresses occur, during design or pilot stage.

Y-5 YOKE KIT
Portable, lightweight magnetic particle testing. Complete kit only $195.

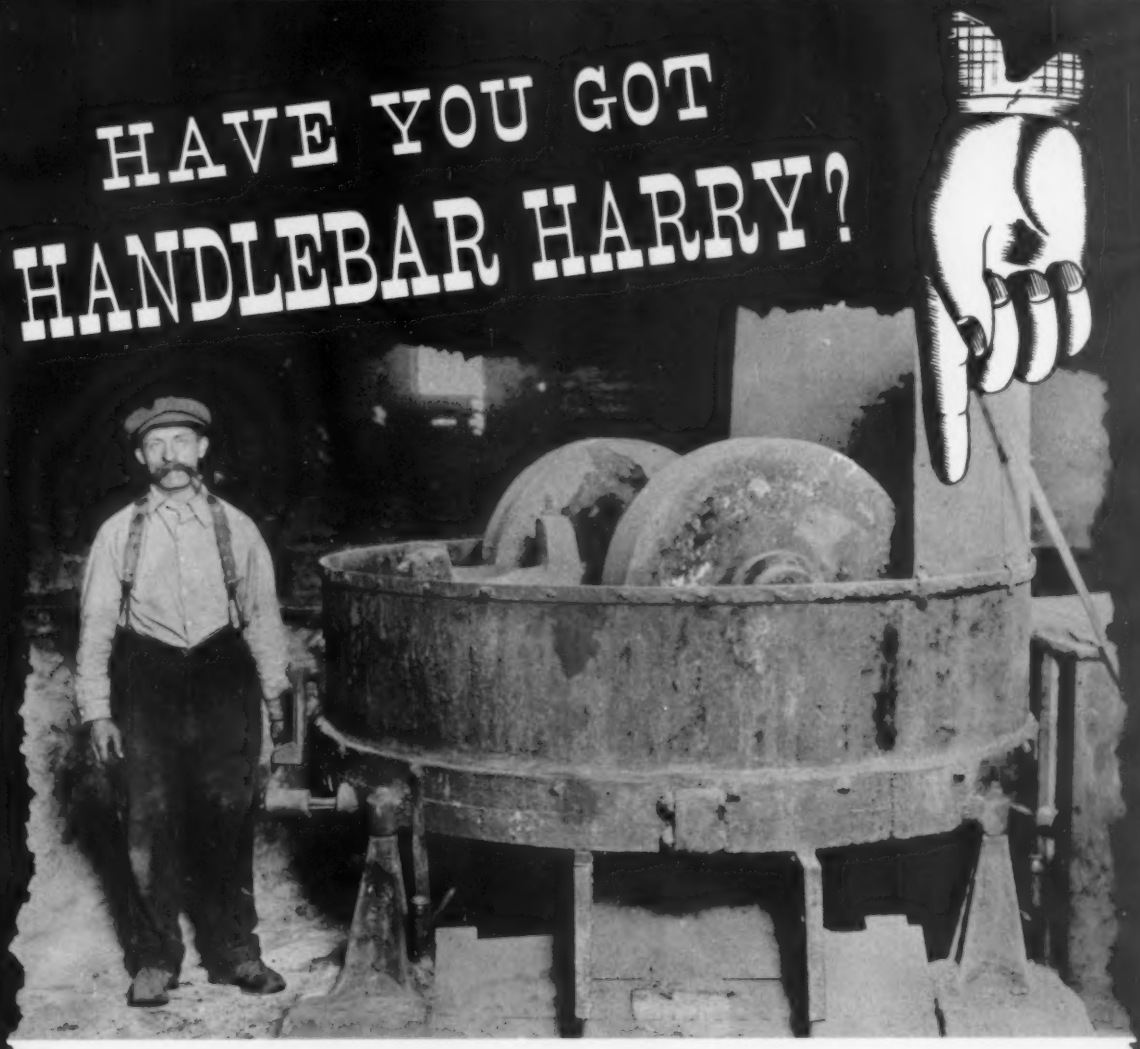
MAGNAFLUX CORPORATION
7350 W. Lawrence Avenue, Chicago 31, Illinois
New York 36 • Pittsburgh 36 • Cleveland 15
Detroit 11 • Dallas 35 • Los Angeles 22

The Hallmark of Quality in nondestructive test systems

Circle 600 on Page 53

Circle 601 on Page 53→

HAVE YOU GOT HANDLEBAR HARRY?



Enter National's $5000 Contest Search

If your Simpson Mixer was built before 1920, you may own *Handlebar Harry* . . . the oldest Mix-Muller still in foundry operation and a machine of great historical significance. National would like to locate this sturdy old-timer and reward you with a jet-propelled, hula-whooping trip to Hawaii for helping them!

All Simpson Users are Eligible to Enter

Even if your Mix-Muller is brand new, you will still be eligible to compete for 19 other prizes in the $5000 *Handlebar Harry Contest.*

Why HANDLEBAR HARRY?

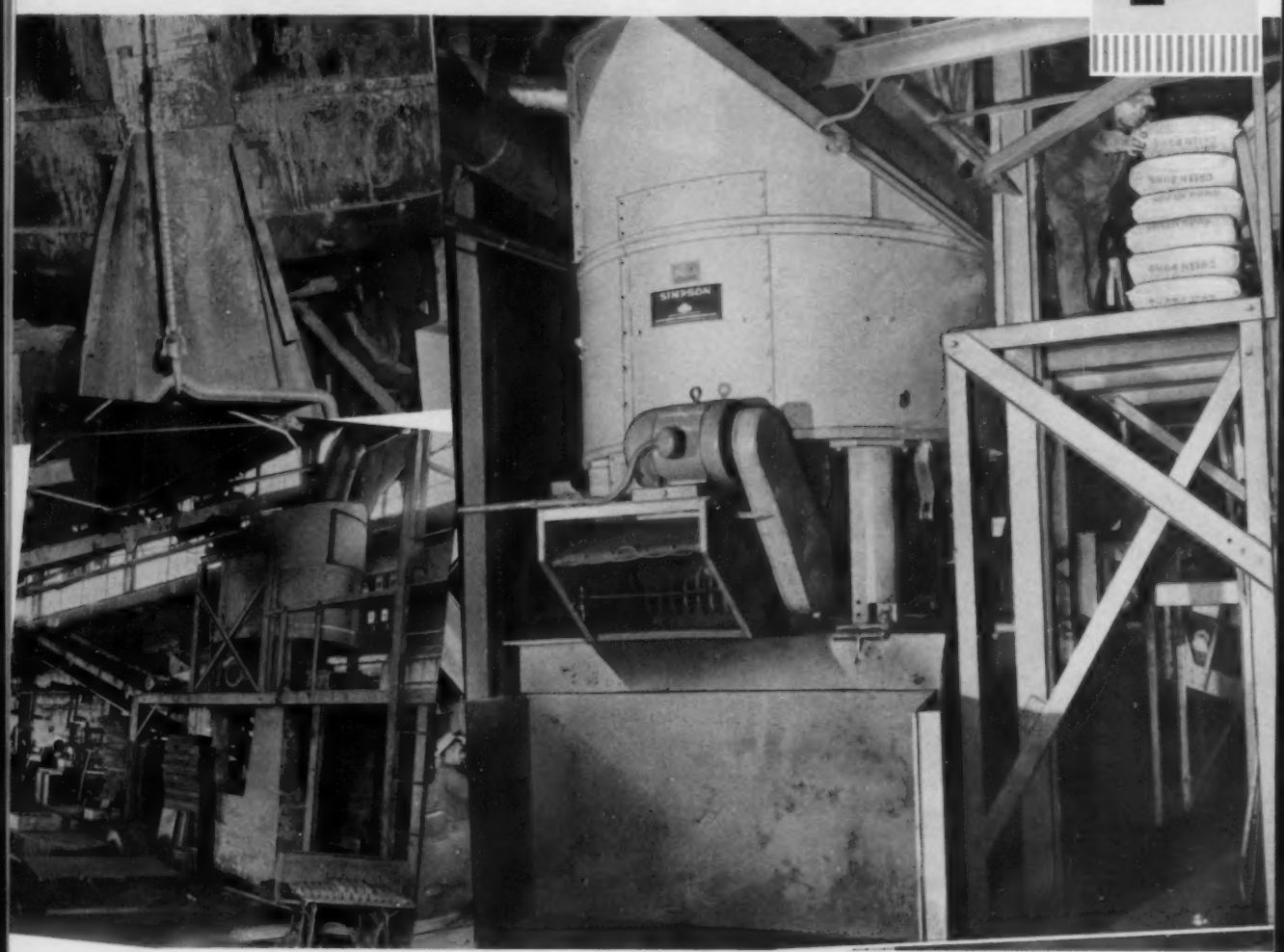
The purpose of the contest is to celebrate the inauguration of National's *Mix-Muller retirement plan* — a program designed to make it easier and more economical for Simpson users to *trade up* to a modern, high production F-Series Mix-Muller—*to meet the production challenge of the '60s.*

See following pages for details ——

SIMPSON MIX-MULLER

NATIONAL ENGINEERING COMPANY · Chicago 6, Illinois

If your Mix-Muller is over 20 years old... A MODERN F



COMPARISON TABLES between Model 2 Simpson built 1930

PERFORMANCE:

	1930 SIMPSON	MODEL F MIX-MULLER	
BATCH CAPACITY	1200 lbs. (max.)	2000 lbs. (min.)	67% more
OUTPUT PER HOUR (G.I. Mold.)	12 tons (max.)	24 tons (min.)	*100% more
DISCHARGE TIME	40 seconds	20 seconds	50% less
MULLING EFFICIENCY	On basis of time required to develop sand characteristics compatible with modern foundry practice overall 2F efficiency is about..		30% greater
EQUIPMENT COST (per ton/hr. of sand prepared)	Based on present day prices, the 2F Mix-Muller will turn out 100% more sand per hour at an equipment investment amounting to...		31% less cost per ton/hr.

CONSTRUCTION:

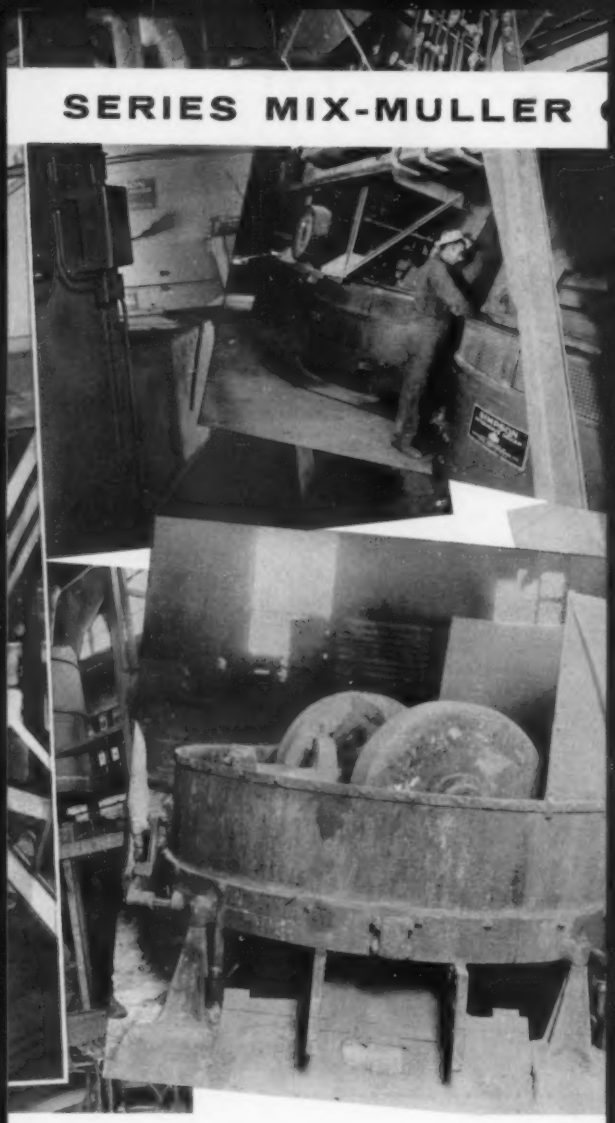
	1930 SIMPSON	MODEL F MIX-MULLER
MULLER SUSPENSION	Rocker arms. 3 weights of mullers 700, 1000, 1600 lbs. Manual adjustment. Non-reversible.	Spring loaded—automatically adjusts to provide more pressure as sand increases in strength. Reversible.
DISCHARGE DOOR	Hand fitted. No adjustment for wear.	Machined to close tolerance and equipped for wear adjustment. Opening is 100% larger.
BEARINGS	Sleeve.	Anti-friction throughout.
DRIVE	Open bevel, direct connected.	V-belt, self-contained, splash lubricated reducer.

*Actual tonnage will vary widely depending upon many variables. However, percentage figure has been firmly established by performance tests.

SIMPSON MIX-MULLER

Trade up! Meet the Production Challenge of the 60's with . . .

SERIES MIX-MULLER



and Model 2F Mix-Muller built 1960

	SERVICE AND OPERATING: 1930 SIMPSON	MODEL F MIX-MULLER
LUBRICATION	5 alemite fittings.	"One stop" centralized system for all interior components.
PLOW ADJUST	Wrench and hammer, from inside crib.	From **top** of cross head.
OVERHAUL	Roll up sleeves.	Roll out mullers and/or turret assy. through removable crib section—without dismantling hoods, hoppers, etc.

F Series MIX-MULLER

Win one of 20 Prizes in National's

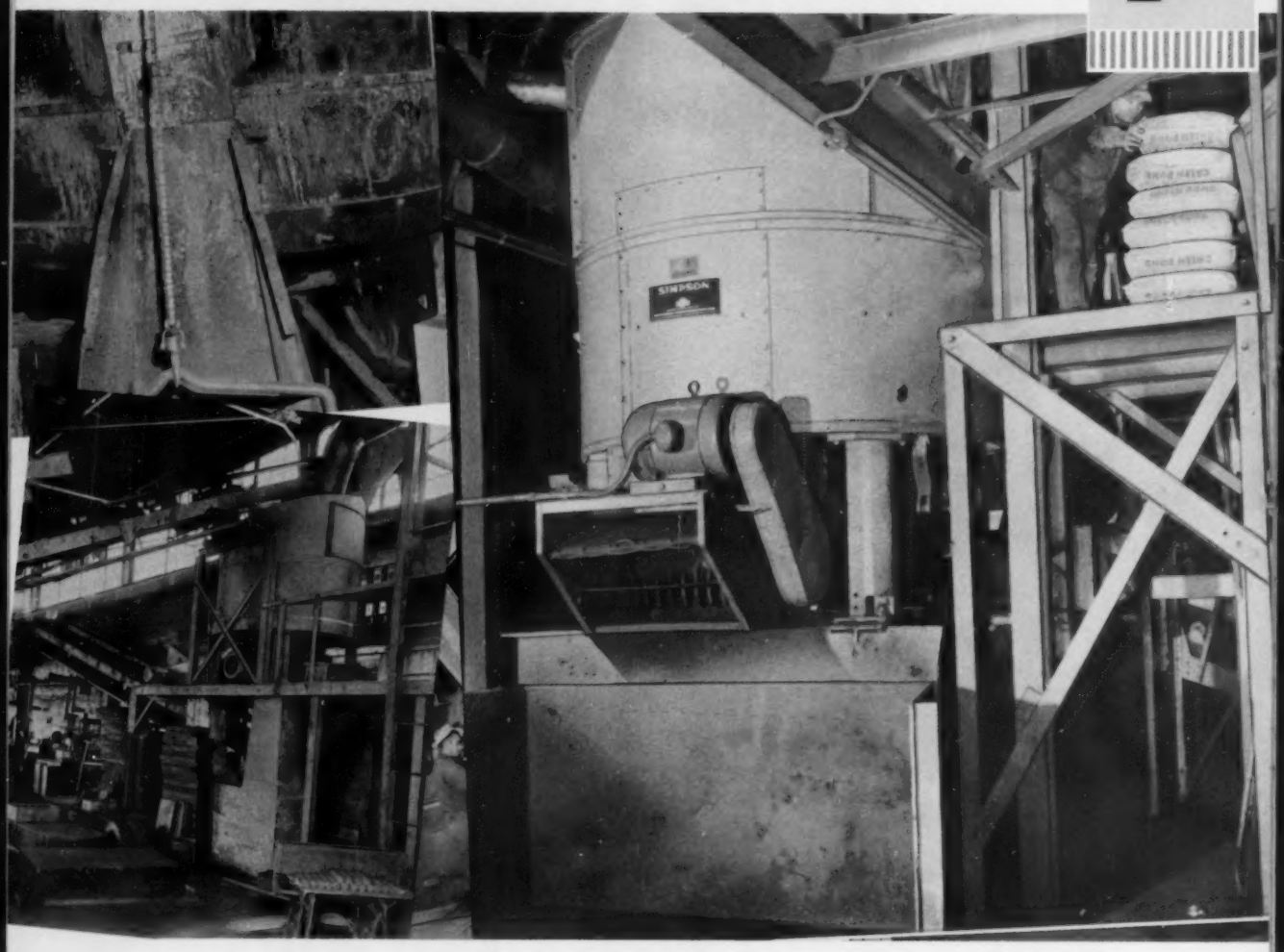
$5000.00

HANDLEBAR HARRY CONTEST

Don't delay! Return your Entry today

See reverse side for Entry Blank

If your Mix-Muller is over 20 years old... A MODERN



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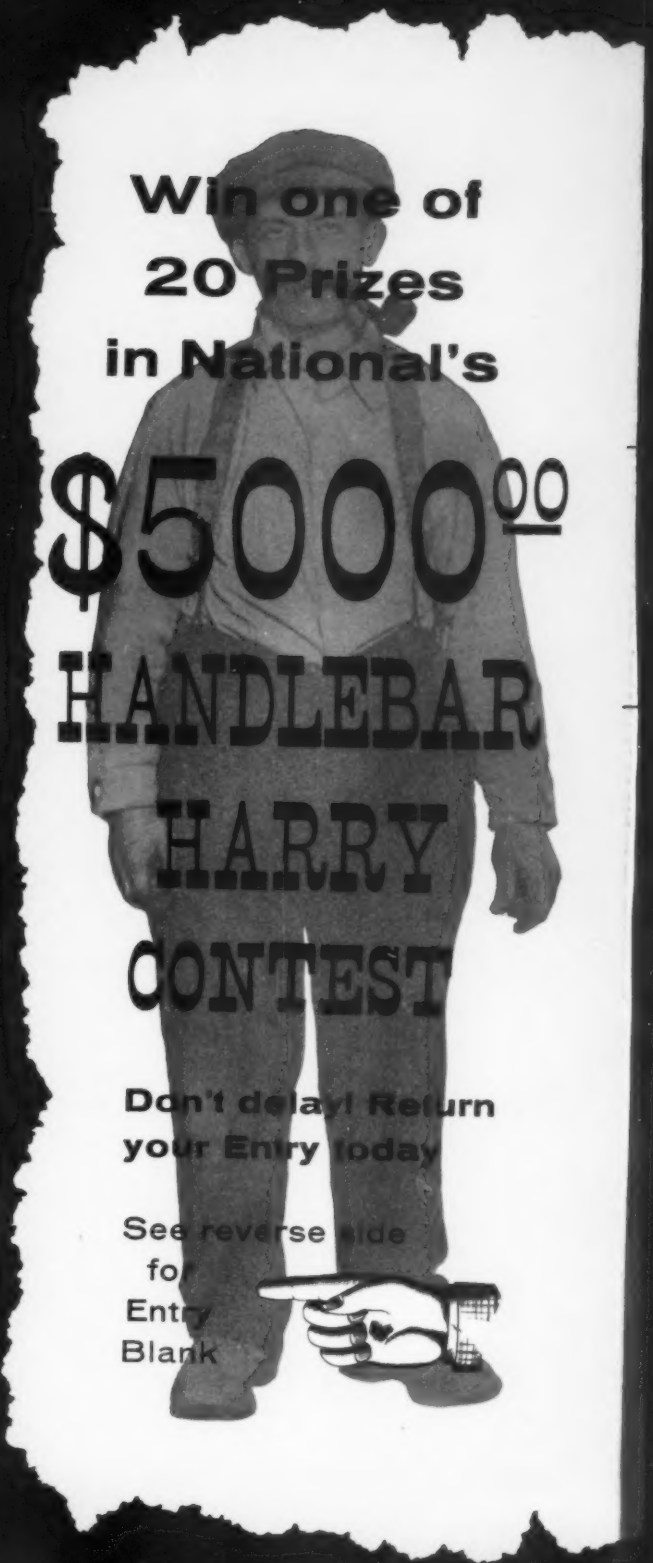
SIMPSON MIX-MULLER

Trade up! Meet the Production Challenge of the 60's with . . .


Win one of
20 Prizes
in National's
$5000.00
HANDLEBAR
HARRY
CONTEST
Don't delay! Return
your Entry today
See reverse side
for
Entry
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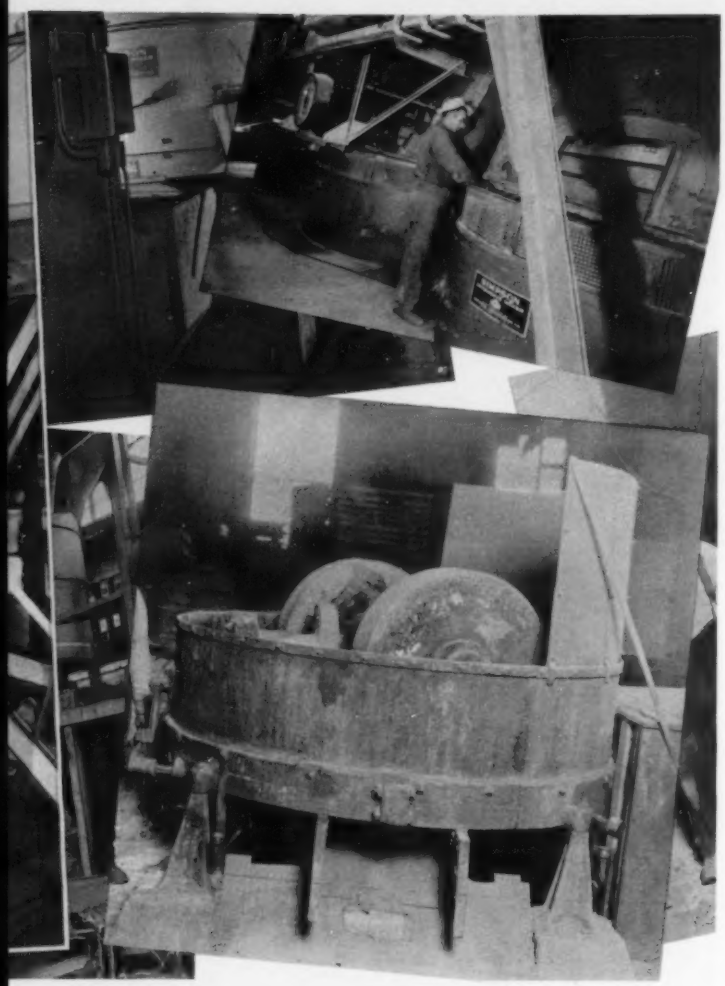
SERIES MIX-MULLER CAN GIVE YOU



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PLOW ADJUST	Wrench and hammer, from inside crib.	From **top** of cross head.
OVERHAUL	Roll up sleeves.	Roll out mullers and/or turret assy. through removable crib section — without dismantling hoods, hoppers, etc.

F Series MIX-MULLER

67% Greater
100% More P
30% More M

If your Simpson M
old and in regular
for an F-Series Mix
the advantages of in
prepared strengths

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Mix-Muller—without receiving
of increased production, greater
gths and lower maintenance.

son chart outlines the basic fea-
Mix-Mullers built before 1951
since. It is designed to tell you

o comparison between the pro-
cy of the two machines.

ment salesman who offers you
ased on the performance of the
lixer and his own 1960 Model
eing straightforward with you.

lix-Muller is described in the
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a 1960 F-Series Mix-Muller.

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equipment payroll, your main-
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lt for mileage. But, the F-Series
built to meet the *production*
'60s, and National is prepared
meeting this challenge with

MIX-MULLER RETIREMENT PROGRAM

f your Mix-Muller was built
before 1951, you can now trade
t in as you would your auto-
nces have been set up which
p value and run up to a liberal
ne price of a new Mix-Muller.
de a recommendation for mod-
arry" is in good shape.
ATIONAL agent or write
ther details on the *Mix-Muller*

NATIONAL ENGINEERING COMPANY
Chicago 6, Illinois

HANDLEBAR HARRY CONTEST

OFFICIAL ENTRY BLANK

Be sure to fill in the 50-word statement below.

1. I have read and agree to the contest rules. Here is my entry. The serial number of our *Handlebar Harry is* _____.
(If more than one mixer, enter oldest number only.)
If no record of serial number, contact your National Agent.

2. This Simpson Mixer is in regular operation in our foundry and has been the property of our company for ____ years.

Your Name_____

Your Company_____

Address_____

City_____ Zone____ State_____

Entry must be postmarked no later than midnight, February 28, 1960.

50-Word Statement

In 50 words or less, tell how this Simpson Mix-Muller has contributed to the success of your foundry operation: Example: **This Mix-Muller has served our foundry daily for _____ years without downtime for repairs. In that time, it has prepared _____ tons of sand.**

(type or print below . . . or attach a separate sheet)

F

DM

TEAR OFF and return to:

HANDLEBAR HARRY
National Engineering Co.,
Machinery Hall, Chicago 6, Illinois

HANDLEBAR HARRY CONTEST

FIRST GRAND PRIZE
(for Handlebar Harry)

Trip to Hawaii for two via American Airlines 707 Jet to Los Angeles and Pan American Clipper to Honolulu. Ten dream days with expenses paid at the luxurious Hawaiian Village Hotel. Side trips of your choice.

3 SECOND PRIZES
(Two for Harry No. 2 and 3; one for best 50-word statement)

RCA "Latham" color console model TV sets in your choice of three wood finishes.

4 THIRD PRIZES
(Two for Harry No. 4 and 5; two for next best 50-word statements)

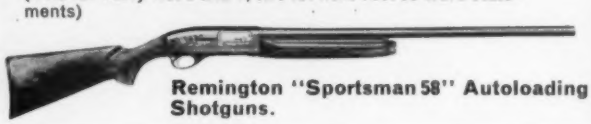
RCA "Fairfield" black and white console TV sets in Blond or Walnut.

CONTEST RULES

Any Simpson Mix-Muller can be entered, as long as entry is accompanied by 50-word statement.

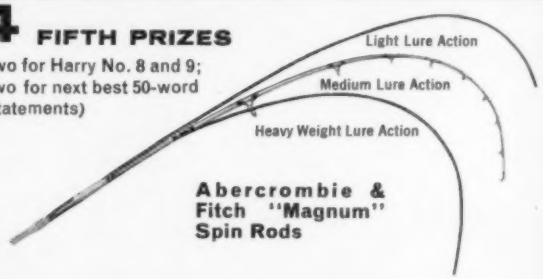
1. Only foundrymen, persons who work for or in a foundry operation are eligible to enter
2. Serial number of the machine must accompany your entry If nameplate is missing, contact National for help.
3. Your **Handlebar Harry** must be in weekly **foundry** usage and have been the property of your company for over one year.
4. More than one entry from a company will be accepted but only one prize will be awarded to any one company.
5. Ties will be settled upon basis of, in opinion of judges, originality and sincerity of thought expressed in 50-word statement. Judges have been appointed by the AFS.
6. All entries must be accompanied by 50-word statement. No entries will be returned and all become the property of National Engineering Company.
7. No cash prizes will be awarded in lieu of trip or merchandise. In event first prize winner cannot take trip, it is expected that winner company will assign a substitute.
8. Contest is limited to residents of the United States and Canada. It is subject to all federal, state and local regulations. Any federal, state or other tax imposed on prize will be sole responsibility of the prize winner.
9. All entries must be postmarked no later than midnight, February 28, 1960. Winners will be announced at the AFS Convention in Philadelphia in May, 1960.

4 FOURTH PRIZES
(Two for Harry No. 6 and 7; two for next best 50-word statements)



Remington "Sportsman 58" Autoloading Shotguns.

4 FIFTH PRIZES
(Two for Harry No. 8 and 9; two for next best 50-word statements)



Abercrombie & Fitch "Magnum" Spin Rods

4 SIXTH PRIZES
(Two for Harry No. 10 and 11; two for next best 50-word statements)

Abercrombie & Fitch "Monogram" 200-six Spin Reels.

DON'T DELAY – RETURN YOUR ENTRY TODAY!

NATIONAL ENGINEERING COMPANY

600 Machinery Hall • Chicago 6, Illinois

From a pile of sand to a rigid mold in 4 minutes

Core for automotive spring hanger

Sodium Silicate-CO_2 Process

You can produce cores in a matter of seconds with the sodium silicate-CO_2 process. With this quicker core-making technique, a binder based on Du Pont Sodium Silicate is mixed with fine core sand . . . CO_2 is the curing agent.

During gassing, CO_2 reacts with the sodium silicate to form a tough gel that hardens while sand is in *direct contact* with patterns. Strong, high-tolerance cores are produced . . . yet collapse easily during shake-out.

The sodium silicate-CO_2 process offers production-line speed . . . eliminates the need for drying and baking equipment. Cores are ready for metal pouring *immediately* after curing. The over-all production cycle is faster. And foundry workers prefer CO_2 molding because there are no objectionable fumes.

Ask your foundry supplier for full details about this time- and money-saving process, or write us for names of suppliers of binders based on Du Pont Sodium Silicate. *E. I. du Pont de Nemours & Co. (Inc.), Industrial and Biochemicals Dept., Room N-2543, Wilmington 98, Delaware.*

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Steps in CO_2 core-making process . . .

1. Standard muller is used to mix sodium silicate-based binder and core sand.

2. Mixed core sand is tamped into form, then packed with pneumatic rammer.

3. Packed core mold is placed over CO_2 jet and quickly cured by gassing.

4. Cured cores are **immediately** ready for metal pouring.

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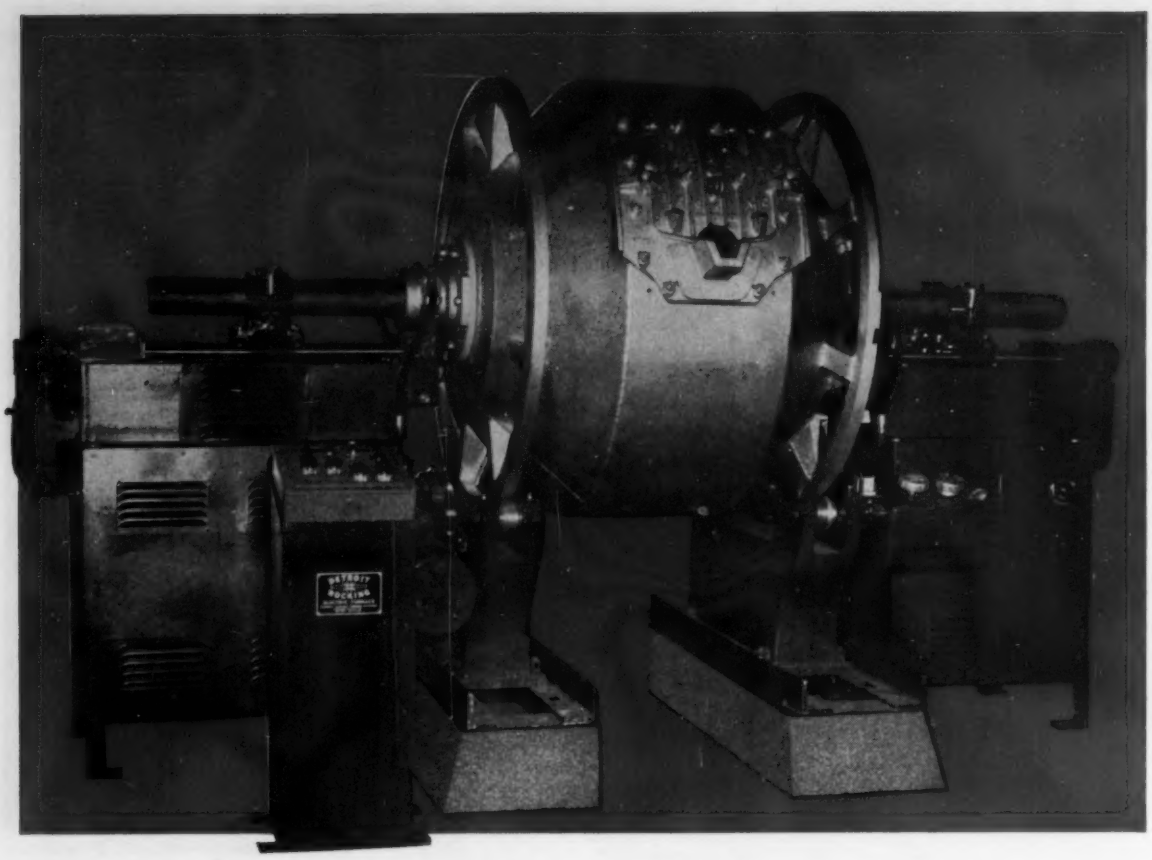

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For full details on the new "P" Series indirect arc Detroit Furnaces, write for Bulletin 5610.

Ratings for furnaces with pedestal-mounted electrodes, motor controlled

Furnace Type	KW Rating	Nominal Cold Charge	Minimum Molten Metal
LFCP	125	350	500
LFNP	150	500	750
LFYP	175	700	1250
AAP	250	1500	3000
AAP	400	1500	3000
CMP	400	4000	8000
CMP	600	4000	8000

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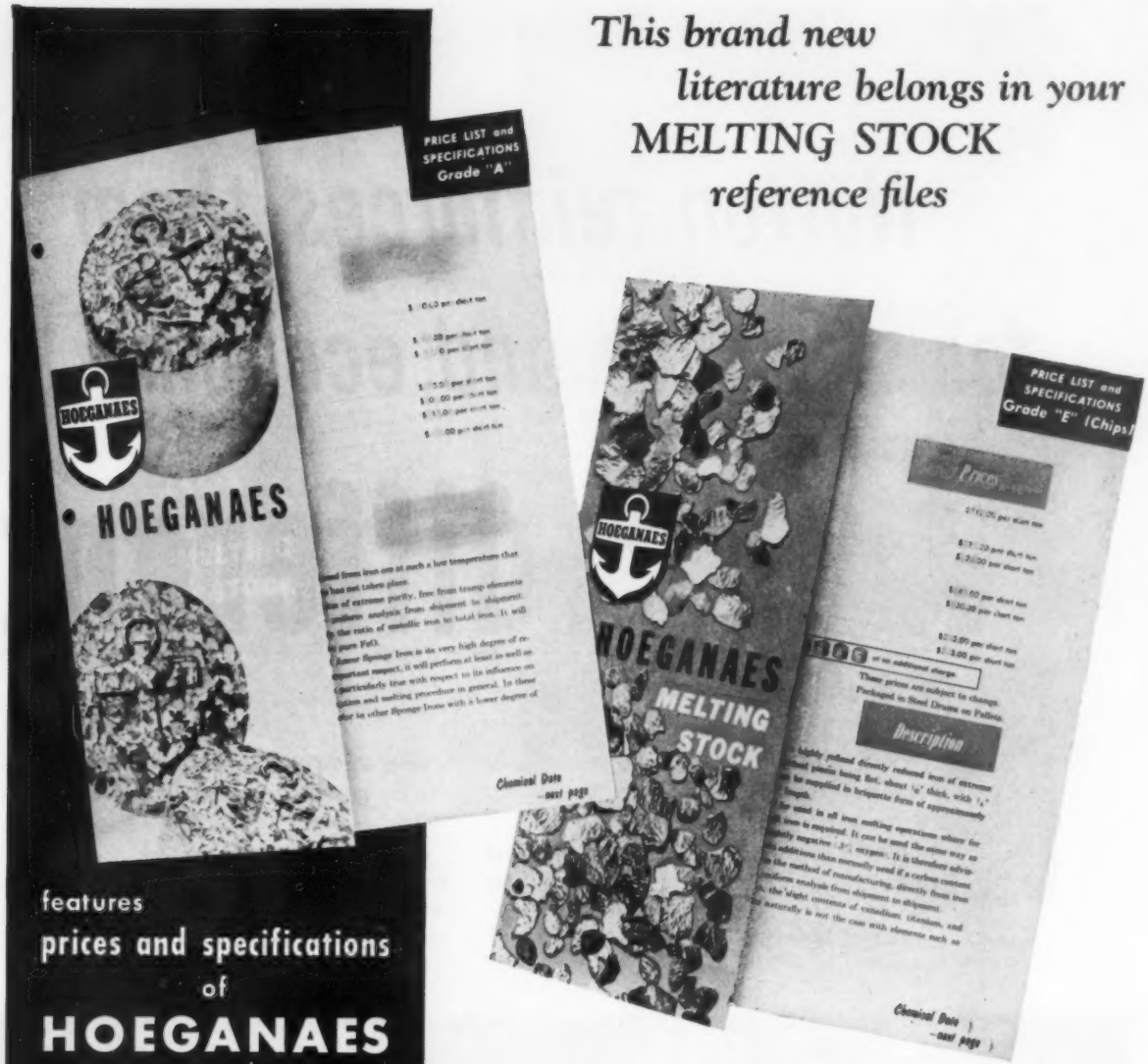

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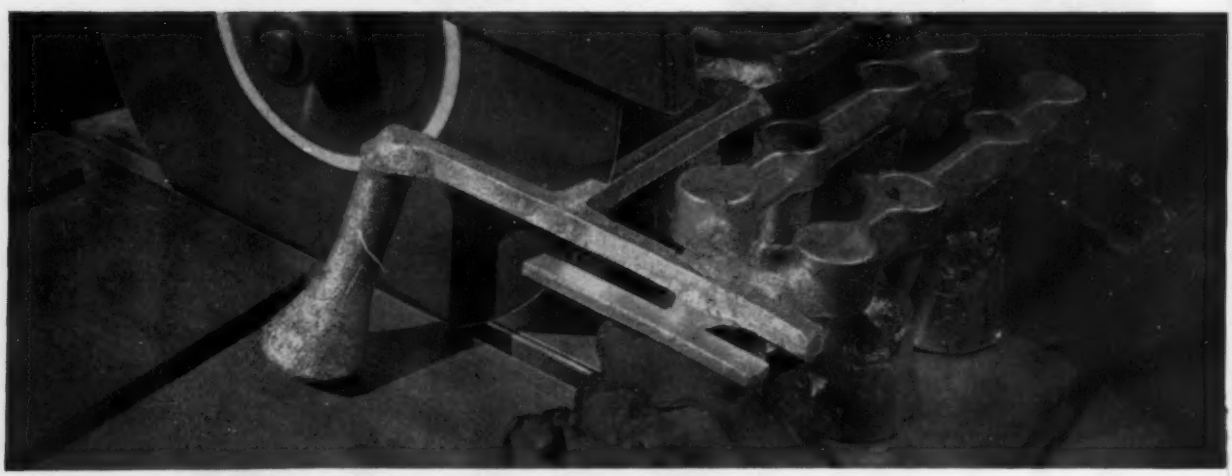

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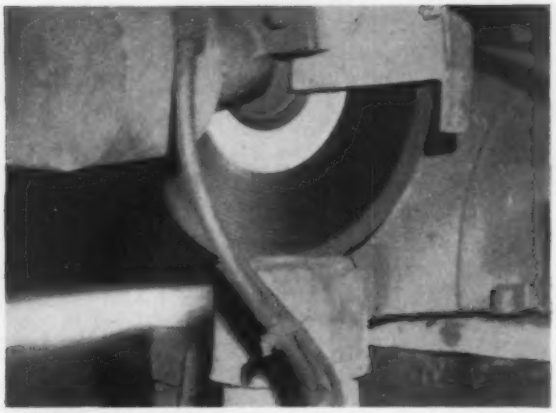

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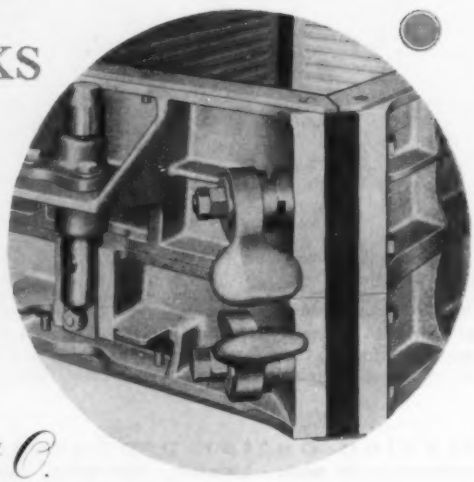

The Standard Jacket is rigid, built to do an outstanding job. Foundrymen agree that it does.

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Write for descriptions and prices concerning these superior Fremont Flasks and Jackets.

The Fremont Flask Co., Fremont, O.

Circle 606 on Page 53

A Salute to the Men of the Great Foundry Industry...

THE Foundry Industry is one of America's great industries. Over 90% of all durable goods require metal castings.

Today's gray iron industry is essentially a *craft* industry. The quality of its products depends upon the skill of its craftsmen.

This is especially true in the case of the *Pattern Maker*. For his skill in creating patterns to exact blueprint specifications is reflected in the quality of every gray iron casting produced.

Pittsburgh Coke & Chemical Company is proud to salute the gray iron foundry Pattern Maker. It is equally proud to serve as a basic supplier of two quality products for the nation's foundry trade . . . Neville Pig Iron and Neville Foundry Coke.

An enlarged (11¼" x 12") reproduction of the above etching, and of subsequent ads of this series, suitable for framing, will be sent without cost upon request.

WSW 7371

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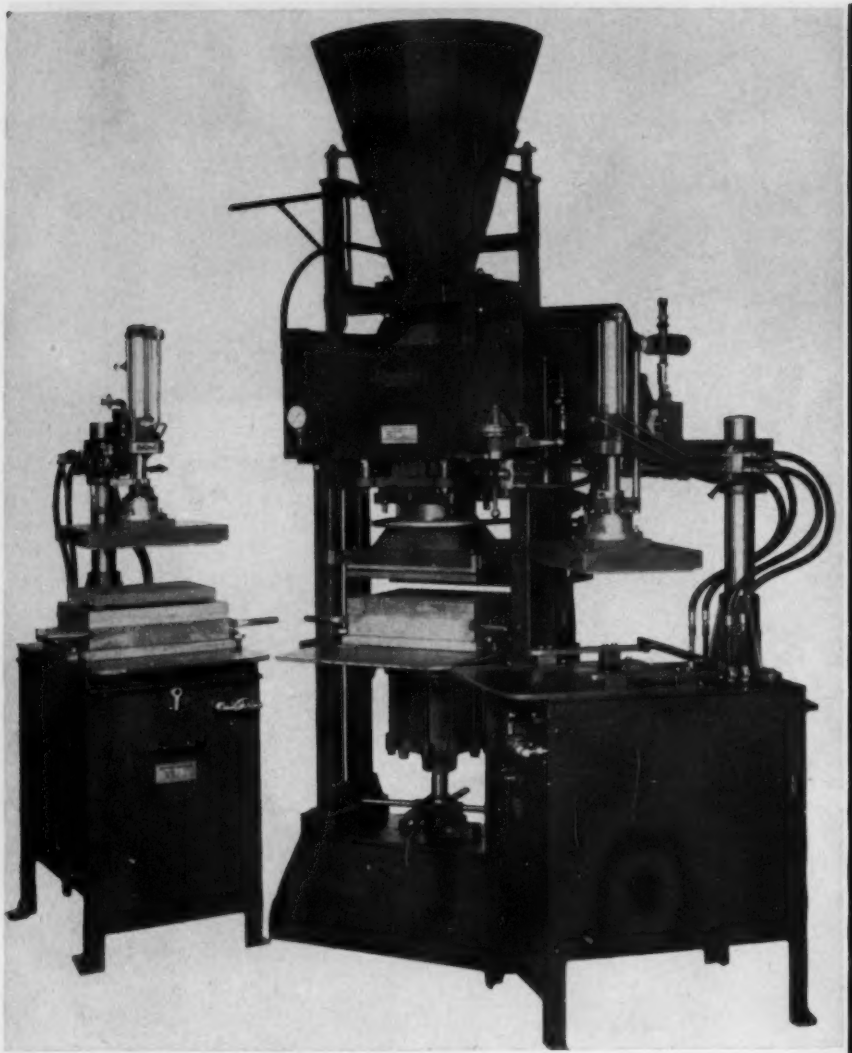

REDFORD CO_2 MOLD MAKING EQUIPMENT

Here is a proven way of applying the CO_2 process to the production of small castings. With the above Redford #420-D Core Blower and (2) Model H-2-M Gassing Stations, one mold is being blown and squeezed while another one is automatically gassed and stripped. Up to 80 complete molds (cope and drag) are produced in one hour. Molds are flat and can be stacked for pouring. Metal yield is greatly increased. Very little floor space is required. Millions of small parts have been cast to close tolerances at reduced costs. For complete information write for BULLETIN No. 421.

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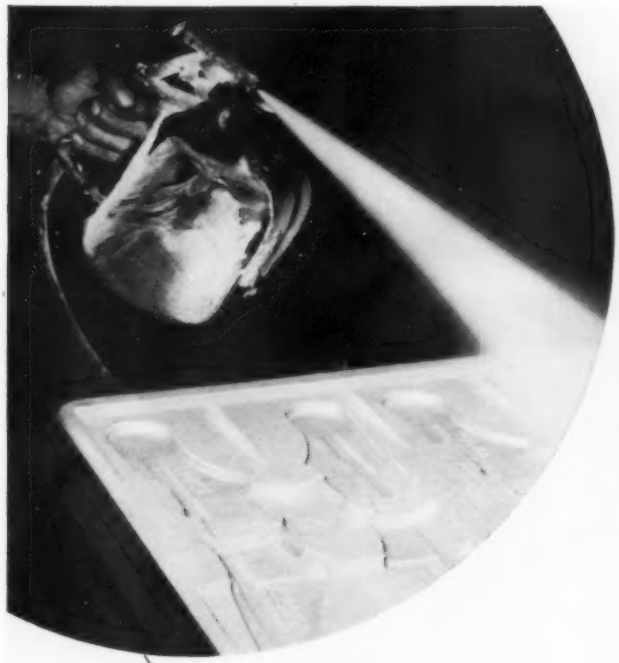
TYPICAL CO_2 MOLD CASTINGS

½ Actual Size



TOP BOND

The secret of a fine clean casting lies at the mold surface. Tying down surface sand can be important and United has found a way to do just that.

Every foundry is proud of the castings it turns out and every foundry researcher has his ear to the ground for new improvements, so this message is for him.

A conditioning agent for cores and molds that builds up surface hardness and ties down surface sand is available as an air drying spray—it's Top-bond. Top-bond combines a moisture-resistant resin with a solvent that dries completely at room temperature. The drying action is fast and the end result is the hardness you have always wished for.

Top-bond has saved many castings by tying down surface sand more firmly at the gates. It has improved the quality of others by providing oven-baked hardness to green sand molds. It has saved many racks of oven-baked cores by bringing back their lost surface hardness.

Many new types of binder require time for setting before cores or molds can be handled safely. Spraying these with Top-bond provides a hard surface at once and protects clean sharp corners. Cores made with the CO_2 Process need this kind of help.

Top-bond is not another item of expense which has to be assumed in the interest of better castings. It is actually a money-saving aid. Research engineers for one large foundry charted their actual saving in the cost of castings when Top-bond found a regular place in their work. Their story of how this was done with actual cost figures is included in a folder that describes Top-bond in some detail. It is yours for the asking.

Write for factual bulletin describing foundry experience with TOP-BOND.

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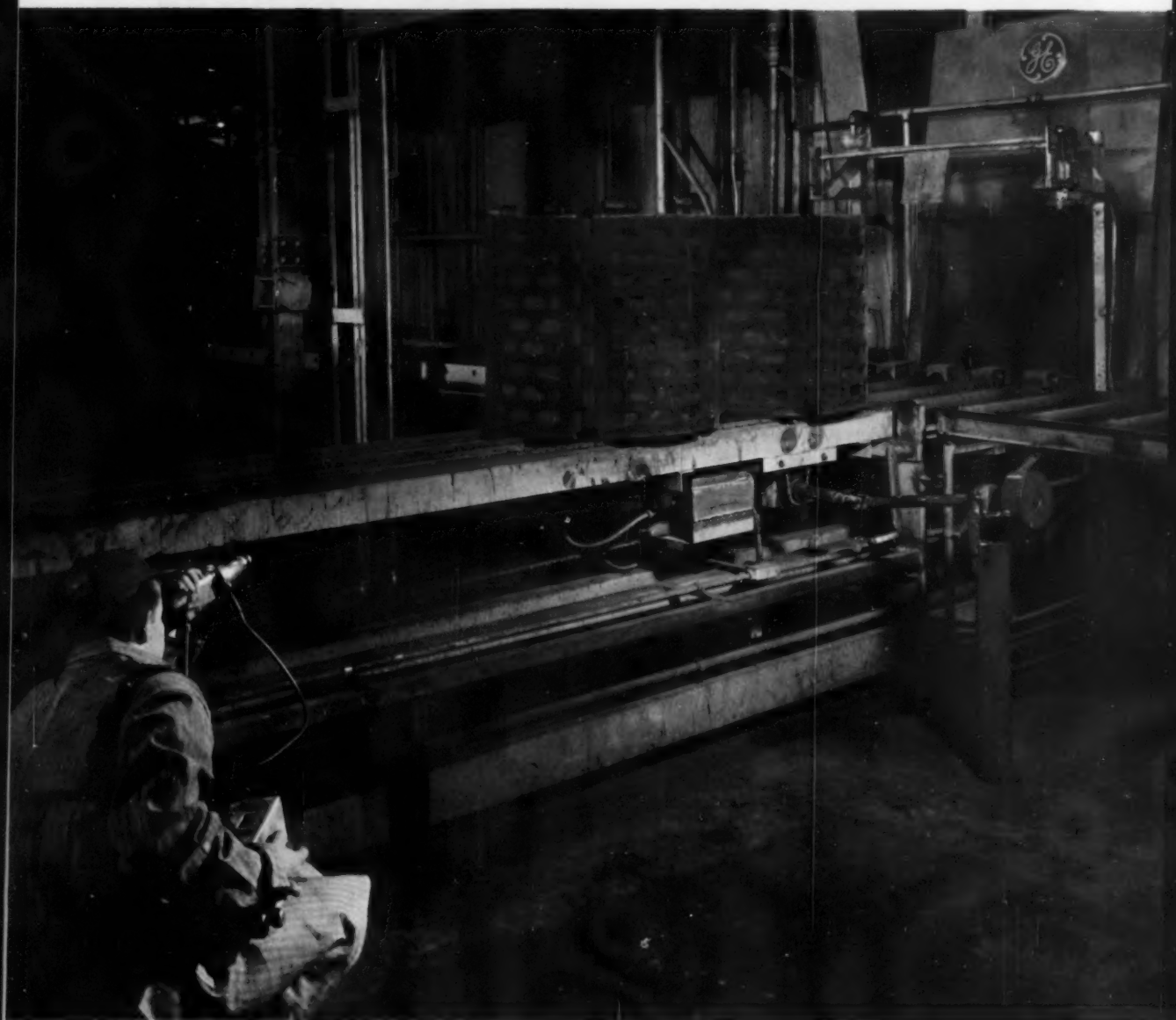
From General Electric . . .

HEAT



Castings automatically transferring from high temperature furnace to other pearlitic annealing equipment at Marion Malleable Iron Works, Marion, Indiana.

GENERAL ELECTRIC

ONE FURNACE SYSTEM DOES SEVEN JOBS

General Electric "systems" design combines furnace, temperature and atmosphere controls, and materials handling to cut annealing cycle 75%, provide added flexibility, and lower processing costs

When you bring your heat processing problems to General Electric, our engineers will give you what you want and need. Whether it's gas or electric, a small batch furnace or a complex, automated system, you need go no further.

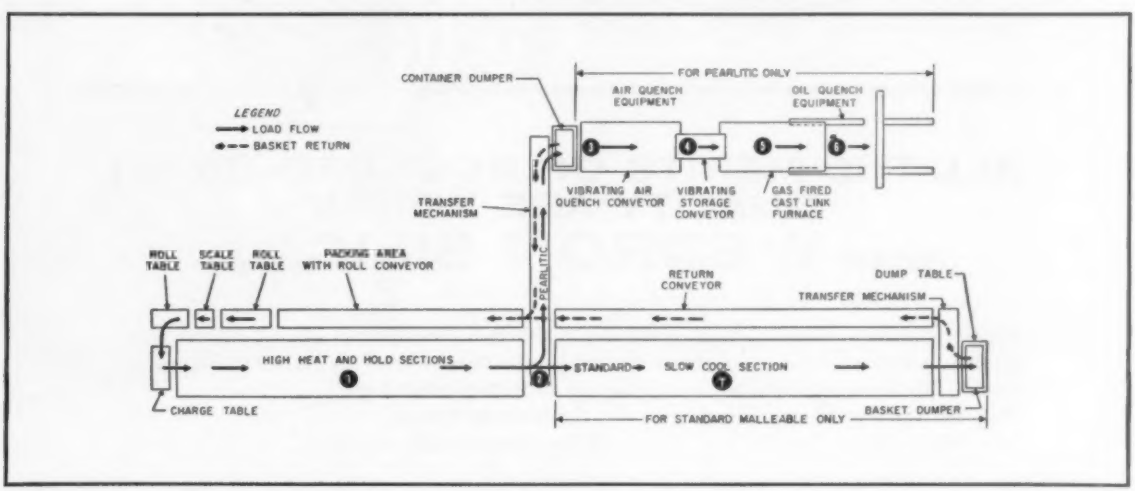
For example, when the **Marion Malleable Iron Works of Marion, Indiana,** set out to acquire "the most modern heat treating equipment which would be very flexible and produce highest quality at a nominal cost," they chose General Electric. The result: a complete system (at left and below) with integrated temperature and atmosphere controls and automatic handling equipment. With one packer and one operator, this system produces 1000 tons of standard malleable iron per month. Or 800 tons of pearlitic and 200 tons of standard malleable per month. Or, with the addition of a separate high temperature furnace, 1000 tons of standard malleable and 800 tons of pearlitic malleable per month. And depending on the type of material required, each of the seven automatic functions (below) can be varied as desired.

In addition, the automatically-controlled annealing cycle has been cut from five days to just 40 hours—a 75% speed-up! Quality is up, and controlled atmosphere (Neutralene) has practically eliminated surface decarburization and assures maximum alloy life of furnace components. Fuel costs are less because of shorter cycles, and labor costs are down. Flexible enough to produce either ferritic or pearlitic malleable, the furnace can even be left loaded and unattended over weekends to allow five-day operation.

As a result, Marion Malleable can offer a higher quality product and rapid delivery to its customers, and thanks to the savings of the G-E system, at a very nominal cost.

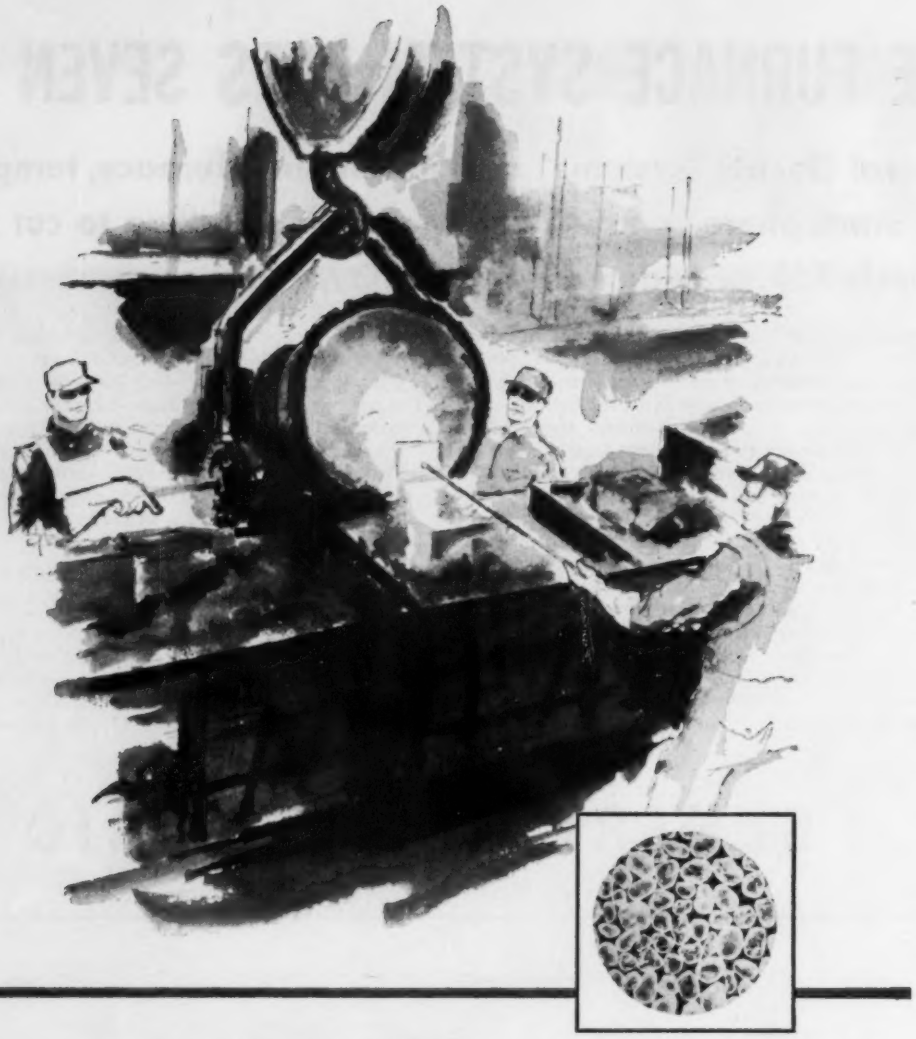
If you're planning a new heat processing installation or modernization—gas or electric, large or small, with or without atmosphere and materials handling equipment—it will pay you to contact your General Electric Apparatus Sales Office. General Electric Co., Section 721-26, Schenectady 5, N. Y.

GENERAL ELECTRIC



ONE SYSTEM, SEVEN JOBS. This complete heat processing system, designed and built by General Electric, automatically (1) heats and holds at temperature, (2) transfers and dumps, (3) air quenches, (4) reloads, (5) reheats, (6) oil quenches, or (7) slow-cools 1000 tons of castings per month with maximum flexibility. Note that two heat processes—pearlitic and standard malleable—can take place simultaneously, depending on mixture of material being processed, and yet work baskets are handled automatically from the time they are placed on the entrance table until the entire cycle is completed.

Circle 610 on Page 53



ALL THE MERITS OF ROUNDED-GRAIN QUALITY ARE YOURS WITH WEDRON SILICA...

We feel the name Wedron means a number of things to foundrymen: Quality, purity, rounded-grain structure, and a wide range of A. F. S. grades to choose from. Of these, quality and the rounded-grain advantages stand out. They tell you that Wedron Sands give you the basis for better controlled castings. Try Wedron today and experience better results.

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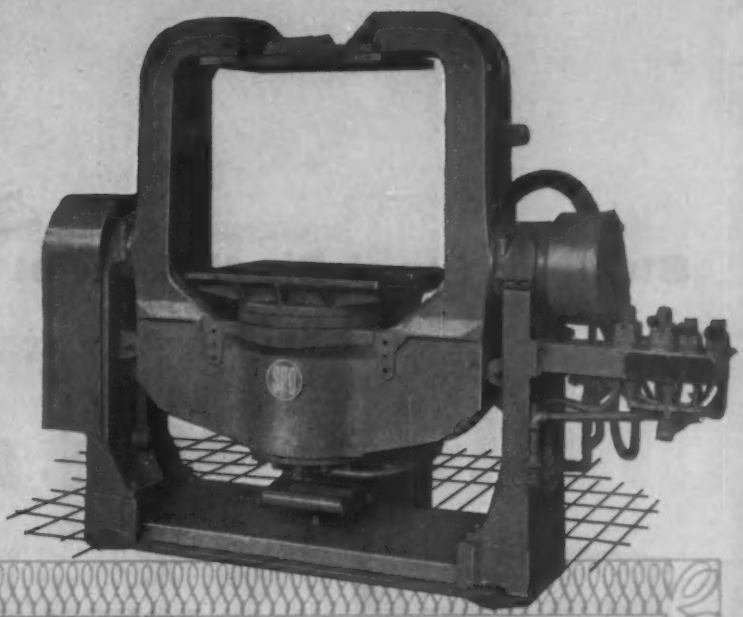

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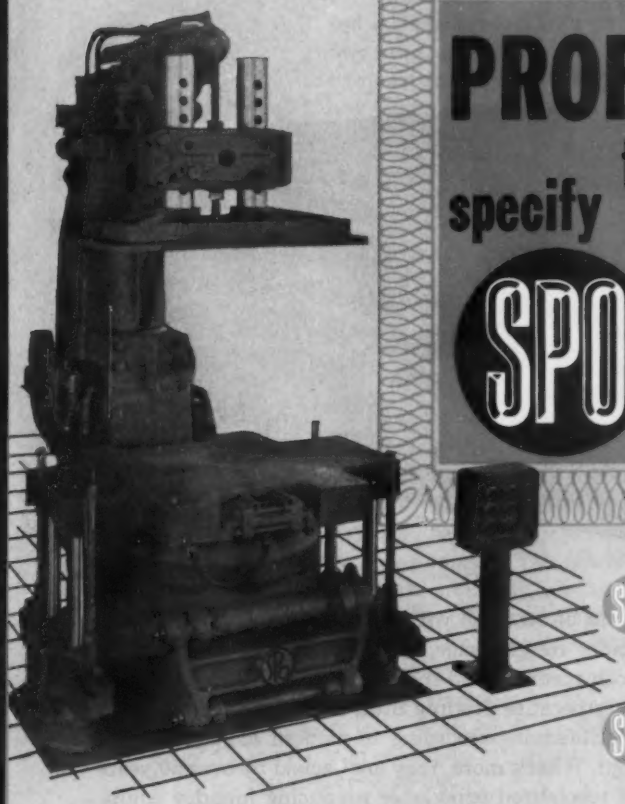

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Jolt-Squeeze-Strip MOLDING MACHINE

Features SPO's patented "inverted jolt" mechanism that guarantees maximum operating efficiency and minimum maintenance. Has a 10" pattern draw, 12" squeeze stroke, 1500-lb. jolt capacity, and 22,000-lb. squeeze capacity on standard 80 p.s.i. line pressure. Pin centers: left to right, 27½ to 42"; front to back, 18 to 34".

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Circle 612 on Page 53

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Tiny but ***TOUGH***

Large but ***LIGHT***

Sterling National Industries, Inc. makes ALL types and sizes of foundry flasks. Some are tiny but tough. Others are large but light. All are designed and built to meet specific job requirements. For example, the small Style "E" flasks are popular in brass or iron foundries. And, the huge 3/8 ND-R special, shown above, is used in a grey iron foundry for producing massive 4000 pound castings.

Every Sterling is constructed to give you a maximum of strength with a minimum of weight. Even under rough usage, you are assured of obtaining both accuracy and speed in molding. This is possible only because Sterling Steel Flasks are built to rigid specifications according to modern engineering design. What's more, they are backed by over 50 years of specialized experience producing foundry equipment. Get all the facts. Write for your copy of the new Sterling catalog.

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WHEREVER METALS ARE CAST FOUNDRY
SEPTEMBER 1959

Spreading the Gospel

The editors recently received the following letter from a metallurgist in a large aircraft company. It carries some interesting implications:

> "Being a metallurgist at ——— ——— in the process control department and in a position to advocate the use of castings over forgings for stainless steel, aluminum, titanium, and magnesium parts, I would like to know if you could supply us with any charts or publications you might have in comparing the mechanical properties, cost advantages, or maybe a "rule of thumb" that could be used in deciding which of these manufacturing processes is more advantageous to use.
>
> "At the present time many of the forgings now used in our work could be easily replaced with good, sound quality castings, but due to a misunderstanding of casting quality and mechanical properties, forgings have been substituted."

Through the kind co-operation of a number of trade association executives, considerable information on properties, design, and application of various types of castings has been supplied this metallurgist.

It is not the job of the trade associations, however, to search out users or potential users of castings and to supply them with technical and application data. For one thing, such an assignment would be almost a physical impossibility.

This is the job of the individual foundry producing castings for sale. The foundry salesman knows the classes of castings that can be produced most successfully by his company. The salesman is the person best equipped to ferret out companies which are using castings in its products or could change to them. He can find the employees of those companies who have a voice in the design of the product or the specifying of material. This is one of the important ways of enlarging the market for castings.

That it was necessary for the aircraft metallurgist to ask for information on castings is to be regretted. We hope it is not indicative of the sort of job foundries are doing in spreading the gospel of the advantages and adaptability of castings in engineering applications.

Frank G. Steinebach
Editor

The EQUILIBRIUM PHASE DIAGRAM

Its Significance to Foundrymen in

Solidification and

● THE EQUILIBRIUM phase diagram is a basic metallurgical tool. It provides knowledge of the equilibrium state of metals and alloys under given temperature, composition, and pressure conditions. Since the common metallurgical phase diagram is for fixed atmospheric pressure, the pressure variable generally is not considered. While metals rarely attain their fully equilibrium state in most metallurgical processes, nevertheless, this diagram is extremely useful in predicting the behavior of alloys under many circumstances.

Phase diagrams are employed widely by physical metallurgists, infrequently referred to by process metallurgists, and rarely used by foundrymen. The development and significance of the diagram and the utilization of phase diagrams in the solid state is one of the primary objectives of any course in physical metallurgy. Many of the fundamentals of metallic behavior are related to this diagram. Process metallurgists will refer to a diagram when necessary to establish the melting points of alloys, the limits of solid solubility, and the heat treatability of metals. Many foundrymen fail to take advantage of the copious information on casting behavior that is available for selecting and processing cast alloys.

Data on numerous basic foundry problems can be obtained easily from a study of these diagrams. Such important factors as the fluidity, mode of solidification, amount of segregation, feeding distance of risers, and type of shrinkage defects can be predicted. Since the phase diagram shows general

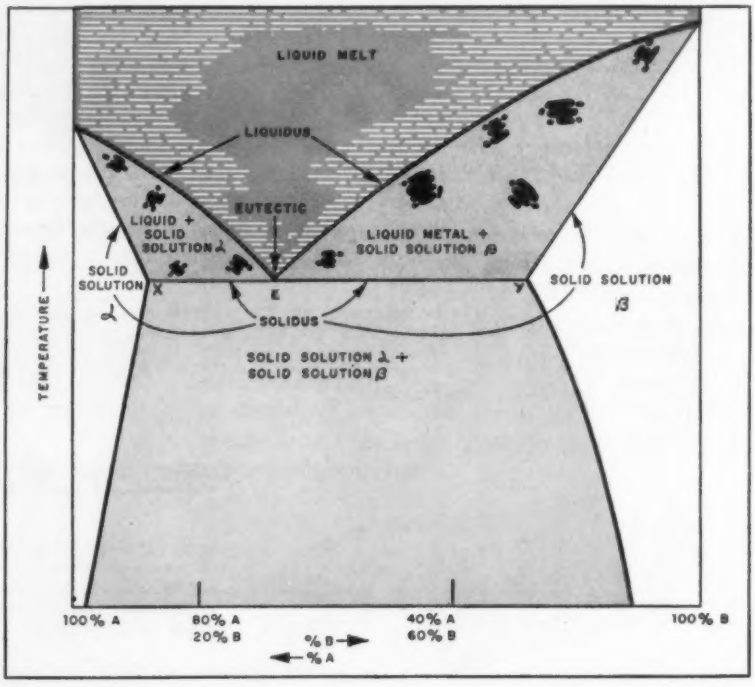
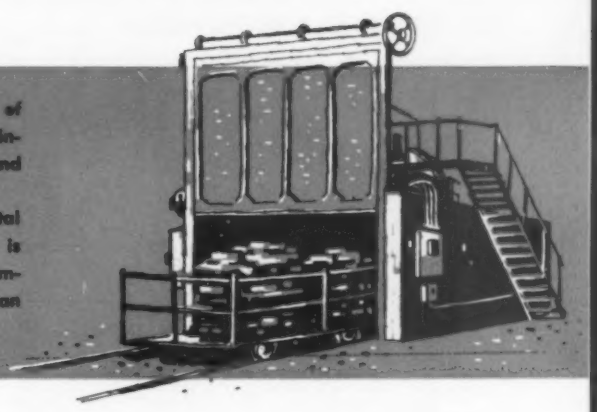


Fig. 1—Equilibrium diagram indicates how composition affects liquidus temperature, as shown by limited solid solution-eutectic equilibrium phase diagram

Articles on the following 38 pages deal with the significance of the equilibrium phase diagram to operating foundrymen seeking information on the solidification and heat treatment of ferrous and nonferrous metals and alloys.

Phase diagrams are described and their use in predicting metal characteristics, casting properties, and heat treating techniques is explained. The articles are based on papers presented at a symposium sponsored by Northeastern Ohio Chapter of the American Foundrymen's Society in Cleveland during February and March.



Heat Treatment

By JOHN F. WALLACE
Associate Professor, Metallurgical Engineering
Case Institute of Technology
Cleveland

solidification conditions, it provides data useful in selecting grain refiners and in predicting the effect of solidification rate on mechanical properties.

In addition, the phase diagram indicates if the properties of alloys can be influenced by heat treatment and is a guide in establishing heat treating techniques. As additional information on the structure of these diagrams is accumulated for more alloy systems, their usefulness to the foundry industry increases. The following paragraphs will describe how the phase diagram influences characteristics of cast metals.

Fluidity — Recent investigations have established that the fluidity of molten metals is influenced primarily by two factors, the superheat and the composition. The superheat is the temperature difference between the pouring temperature and the liquidus or melting temperature of metal. The equilibrium diagram indicates how composition affects the liquidus temperature, such as shown by the simple eutectic —limited solid solution type of diagram in Fig. 1. The effective superheat of a selected pouring temperature can be determined rapidly from the diagram for any given composition. The influence of pouring temperature on the fluidity of carbon steels within a fairly narrow composition range is illustrated in Fig. 2.[1]

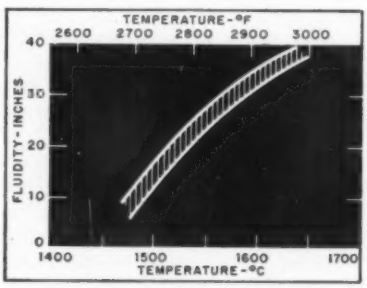


Fig 2—Influence of superheat (pouring temperature) on fluidity of medium carbon steels[1]

The fluidity of metals with a single melting temperature is generally superior, for the same effective superheat, to those exhibiting a liquidus-solidus temperature spread. The comparative fluidity for alloys with the same superheat decreases as the liquidus-solidus temperature difference increases. The better fluidity of the single melting temperature metals apparently results from the continued flow of these metals in the fluidity channel at the melting temperature.

These metals solidify starting at the outside of the channel with relatively smooth sides and permit continued flow in the center. The more mushy type of solidification, however, with a greater liquidus-solidus temperature range results in solid metal particles in the interior of the fluidity channel, even during the initial stages of solidification. This causes more interference with flow at slightly below the liquidus temperature and reduces the fluidity.

The influence of the equilibrium diagram on fluidity at two different amounts of superheat is shown for aluminum-copper alloys in Fig. 3.[2] It is evident from this work that the less the liquidus-solidus spread, the greater the fluidity. Eutectics exhibit good fluidity for two reasons: First, the single solidification temperature. Second, the low melting temperature resulting in greater superheat for a given pouring temperature.

The effectiveness of the phase diagram in determining fluidity is demonstrated in the foundry by the performance of many common cast metals. The high fluidity of such eutectic compositions as 4.3 per cent carbon equivalent gray iron and AL-12 per cent Si alloys is well known. The poor fluidity of the Al-Mg, Cu-Sn, and white or malleable iron with their large liquidus-solidus temperature range also is general knowledge.

Mode of Solidification—The phase diagram provides definite information on the solidification mechanism. A vertical line drawn through

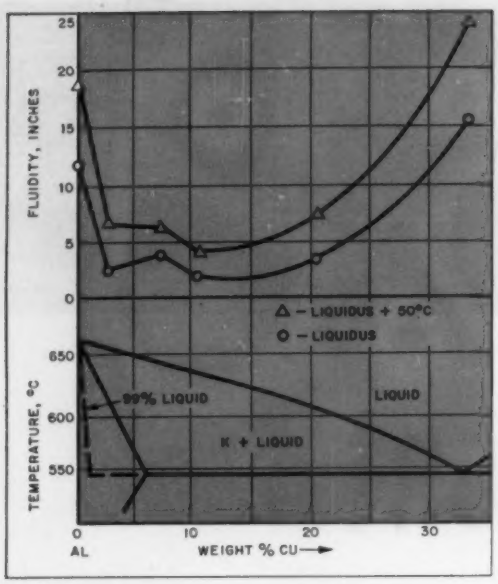


Fig. 3 — Influence of the equilibrium phase diagram on fluidity at two different amounts of superheat for aluminum - copper alloys[2]

the composition of the melted alloy perpendicular to the composition axis will indicate the phases obtained during solidification. The phases may include pure metals, solid solutions, intermetallic compounds, eutectics, or combinations of eutectics with any of the first three.

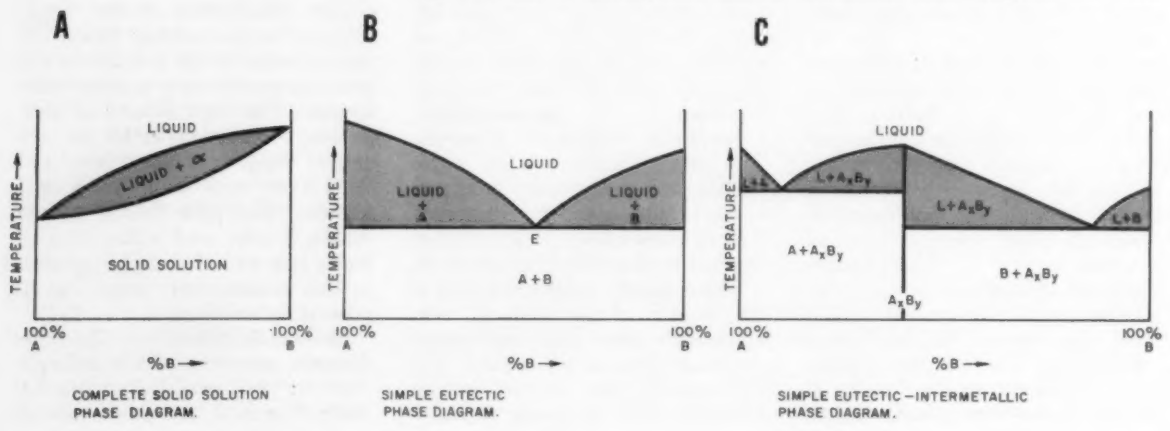
Considering the equilibrium diagram in Fig. 1, when the vertical line falls at either 100 per cent A or B, a pure metal is solidified. When this line is to the left of X and falls in the entirely α solid solution range or to the right of point Y in the β range, the alloys solidify entirely as solid solutions. A melt of composition E solidifies entirely as a eutectic of $\alpha + \beta$; compositions between X and E as combinations of the solid solution and eutectic; and analyses between E and Y solidify partly as solid solution followed by the remainder as a eutectic of α and β.

The mode of solidification can be determined in a similar manner for other types of equilibrium diagrams, such as those demonstrated in Fig. 4A, B, and C. Fig. 4A is a simple, complete solid solution type (similar to the Cu-Ni system) and will solidify as pure metals at 100 per cent A and B and as solid solution for all other compositions. A simple eutectic phase diagram, as that shown in Fig. 4B (similar to the Cd-Bi system) will solidify as pure metals at 100 per cent A and B, and as a eutectic of A and B at E. Between 100 per cent A and composition E, metal A will solidify followed by the eutectic; between E and 100 per cent B, metal B will freeze followed by the eutectic. Alloys with intermetallic phases such as illustrated in Fig. 4C and similar to the Mg-Si or Bi-Te systems, solidify in the same manner as two separate, simple eutectic systems.

Pure Metal Solidification—When the composition is that of a pure metal or intermetallic compound (100 per cent A, 100 per cent B or AxBy), solidification will occur with a smooth wall because of the single melting temperature. The pure metals usually exhibit both a chill and columnar dendritic zone. The intermetallics solidify with some preferred orientation, but no segregation occurs in either case. Solid solutions generally solidify with a chill zone and some columnar dendrites, as shown in Fig. 5A. In this case, a spread between liquidus and solidus temperature results in a mushy zone containing both liquid and solid. In addition, the first metal to solidify is richer in solvent atoms and causes a concentration of solute atoms in the remaining liquid.

These conditions favor continuous growth from the wall of the mold for part of the solidification period but finally, equiaxed, detached crystal form in the unaltered liquid as demonstrated at the right in Fig. 5A. This interrupts the continuous solidification from the wall. Eutectics, however, exhibit a cellular type of solidification in which each grain forms outward from a central nucleus rather than with the progressive type of growth of pure metals and solid solutions. Eutectics also contain two phases compared to the

Fig. 4—Mode of solidification can be determined from diagrams like these



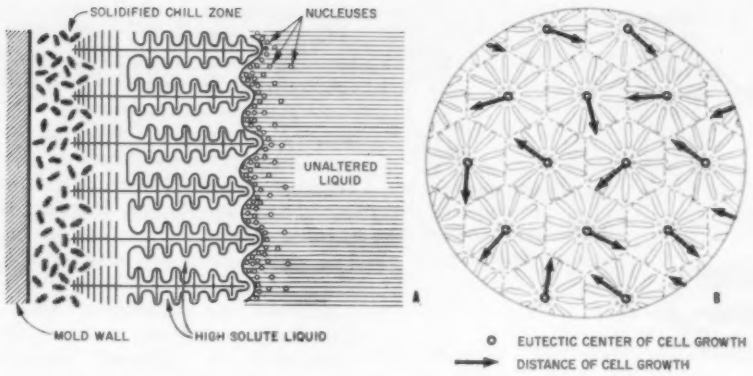


Fig. 5—(A) Schematic representation of solidification in a solid solution alloy. (B) Schematic solidification of eutectic

single phase of the other metals. The method of growth and appearance of an idealized solidified eutectic is illustrated in Fig. 5B.

An alloy that solidifies by a combination of pure metals, solid solutions, or intermetallic phase plus a eutectic exhibits both types of mechanisms as the melt is cooled. First, the dendrites or crystallites of the pure metal, solid solution or intermetallic compound solidify; then the cells of the eutectic freeze as the temperature and composition reach the eutectic point.

A schematic representation of this combination of solidification is shown in Fig. 6.[3] The dendritic solid solution has solidified first followed by the cells of the eutectic. These mechanisms of solidification exert considerable influence on the foundry characteristics and final mechanical properties of the casting.

Grain Refinement—Use of the equilibrium diagram for the selection of effective grain refiners is somewhat more complex than for many other characteristics. Inoculants are additions to molten metals which provide solid, finely divided, stable particles of elements or compounds which can serve as foreign nucleuses for heterogeneous solidification.[4,5,6] The effectiveness of these particles in producing grain refinement depends on a matching of the crystallographic structure of the particle and the solidifying metallic phase. Complete development of the phase diagram shows the structure of the solidifying phase so that trial inoculants can be selected scientifically.

In many cases, the actual addition to a melt is not the grain refiner but only reacts with the constituents of the molten metal to produce effective foreign nucleuses. Products of reactions within the melt usually are more effective as these nucleuses because of their cleaner surfaces. The reactions which form these effective nucleuses frequently have separate equilibrium diagrams (usually eutectics or peritectics) with the metal to be refined. In these cases, the separate equilibrium diagram provides information on the concentration of addition.

Grain refinement also can be influenced or assisted by the constitutional undercooling that accompanies the segregations in the liquid during the solidification of solid solutions.[4,6] The greater the liquid segregation of the solute, the more grain refinement is expedited by this means.

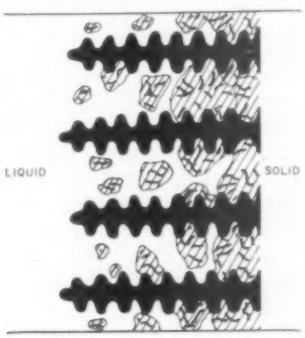
Segregation—As previously discussed, pure metals and intermetallic compounds solidify without segregation. The eutectics separate into the two constituent phases but the two are mixed together uniformly and no intermediate compositions are present. Segregation of nonmetallic inclusions, liquid films, and other foreign particles occurs at the grain boundaries. But these are segregates of impurities or residual elements in the metal, not of actual constituents. Solid solutions, however, because of their range of solidification temperatures or liquidus-solidus spread do exhibit considerable segregation.

The extent of these variations in composition depends upon the temperature difference between the liquidus and solidus. The greater this spread, the larger the amount of segregation of solute and solvent atoms. An approximation of the influence of this liquidus-solidus spread on segregation is shown schematically in Fig. 7. With the considerable liquidus-solidus temperature range in Fig. 7A, the first metal solidified (composition 1) contains only approximately 5 per cent B and 95 per cent A; the last liquid to solidify, however, is composed of 40 per cent B, 60 per cent A. Therefore the composition of this solid is much richer in B (composition 2).

The horizontal or isothermal lines drawn from the average composition vertical line to the solid solution and liquid fields show the variation in composition of these phases. The net result is a large difference in per cent B from the center to outside of the dendrite of solid solution. If the spread between liquidus and solidus temperature is minor, however, such as shown in Fig. 7B, the segregation is much less. Only a 10 per cent difference in per cent B (from 10 to 20 per cent) occurs between the first solid formed and last liquid to solidify in this latter figure. The equilibrium diagram, then, is capable of explaining the greater segregation of the alloys in the Cu-Ni system compared to the alpha Cu-Zn alloys.

The true equilibrium diagram assumes that sufficient diffusion occurs to eliminate these differences in composition. The rates of diffusion, particularly in the solid metal, are so slow that the large scale

Fig. 6 — Schematic representation of combined solid solution and eutectic solidification[3]



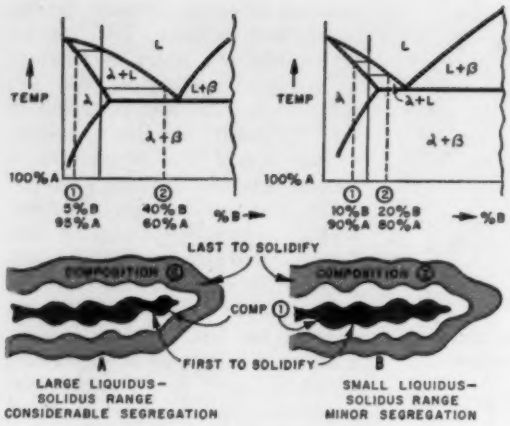


Fig. 7—Segregation of alloy constituents in the solidification of a solid solution alloy

segregations shown in Fig. 7A occur. In fact, these amounts are exceeded in the nonequilibrium case.[4] These segregations produce inhomogeneities and influence the casting properties appreciably.

Feeding Distance—The effect of numerous properties of metals on the feeding distance from risers has been shown in a recent article.[7] Some of the more significant of these features are revealed by the equilibrium phase diagram. The spread between the liquidus and solidus temperatures influences feeding distance appreciably. The greater this temperature difference, the less the feeding distance from a riser.

This effect of liquidus-solidus spread is shown schematically for two different solid solution phase diagrams in Fig. 8. The same thermal gradient is assumed across the plate casting sections shown In the bottom of this figure. The location of the liquidus and solidus temperatures on the cross section of this plate section are shown.

A large difference in liquidus-solidus temperature produces a considerable depth of the mushy or liquid plus solid zone during solidification as shown in Fig. 8A. This extensive mushy zone interferes with metal flow from the riser or feed source, and short feeding distances result. The small liquidus-solidus temperature difference indicated in Fig. 8B, however, solidifies with only a short mushy zone. Under these conditions the interference with the flow of feed metal from the risers is minor and the feeding distances are long. By this means the effect of higher carbon content in reducing the feeding distance of steel can be explained.

The mode of solidification also affects the feeding distance from risers. Pure metals with their smooth wall solidification resulting from a single melting temperature exhibit long feeding distances. The solidification of eutectics, however, even with the single melting temperature, causes considerable restriction on flow from the riser to the solidifying casting and produces relatively short feeding distances. The cellular type solidification occurs across the section as indicated schematically for the eutectic cells in Fig. 6. This is a mushy type solidification and causes considerable interference with feeding from risers.

The extent of the mushy zone and feeding distance also is influenced by the thermal gradient across the section. Steeper thermal gradients reduce the length of the mushy zone in solid solution and eutectic alloys. The greater the difference in temperature between the solidifying metal and mold, the steeper the resulting thermal gradient. Equilibrium phase diagrams show solidification temperatures and provide a direct measurement of the metal to mold temperature difference.

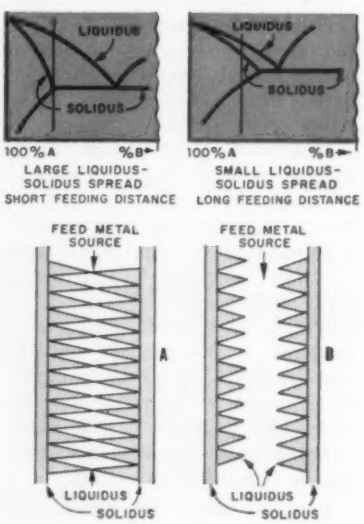
Type of Shrinkage—The schematic drawings in the lower part of Fig. 8 illustrate the type of shrinkage defects that can be expected in these two different solid solution alloys from an inadequate number and location of risers. The large liquidus-solidus spread shown at the left will result in unfed liquid metal distributed over a considerable cross section of the casting, causing scattered or dispersed porosity over this cross section as a result.

On the other hand, the smaller liquidus-solidus temperature range illustrated at the right in Fig. 8 will confine the unfed region to the very center of the cross section during the very last stages of solidification. This results in so-called centerline shrinkage. The equilibrium diagram is capable of accounting for the centerline shrinkage of the lower carbon steels and the dispersed porosity of Cu-10 per cent Sn bronzes. Centerline shrinkage usually is not as objectionable as dispersed porosity since it is not as apt to cause leakage in pressure tight vessels or low strength in bending.

Hot Tearing—Two general publications have shown the influence of the significant variables on the susceptibility of solidifying metals to hot tearing.[8,9] It has been well established that hot tearing occurs during a time when less than 10 per cent of the metal is unsolidified. The conditions for hot tearing are shown schematically in Fig. 9. When large amounts of the solidifying metal are liquid, extension of the solidifying metal from any applied stress is uniform, resulting in low strains at any point.

Completely solidified metal has sufficient ductility to creep or yield without fracture. However, when only a small amount remains unsolidified, the structure lacks both

Fig. 8—Effect of liquidus-solidus spread on feeding distance from riders. Same thermal gradient in castings



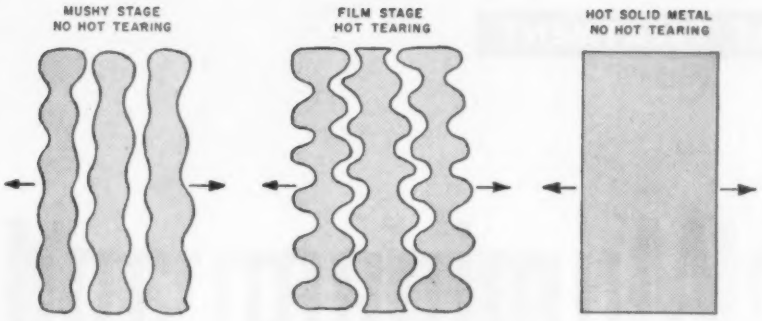


Fig. 9—Mechanism of hot tearing during film stage. Hot tearing occurs during a time when less than 10 per cent of the metal is unsolidified

strength and ductility. The strains become highly concentrated at the liquid films and hot tearing occurs. These hot tears result from the high strains produced by contraction of the casting as solidification progresses.[10]

The longer the film stage exists and the more contraction that occurs during this period when hot tearing susceptibility is high, the greater the susceptibility to hot tearing. Consequently, a long liquidus-solidus range increases susceptibility by increasing the time and amount of contraction during the liquid metal film period. The effect of the liquidus-solidus range on hot tearing explains why the Cu-Si alloys are more susceptible than pure Cu and the Cu-Al bronzes even though the amount of contraction which occurs is similar.[9] A short liquidus-solidus range will not always indicate no hot tearing susceptibility, however, particularly in alloys with a peritectic type solidification.

The cellular, mushy type solidification exhibited by eutectics reduces hot tearing susceptibility. This effect can be attributed to three factors: First, the single temperature of solidification. Second, the reduced contraction of most eutectics. Third, the healing of hot tears produced in dendritic metals by liquid eutectic when the metal solidifies by a combination of dendrites and eutectics.[8] For these reasons gray irons and Al-12 per cent Si alloys rarely hot tear and the addition of 5 per cent silicon to solid solution Al-Cu alloys will stop hot tearing. The influence of these various factors on hot tearing has been summarized in Fig. 10.

Any phase that produces a low melting liquid film at the boundaries of the dendrites or grains greatly contributes to hot tearing. This type liquid film is produced by sulfur in steel and phosphorus in cast iron and the Fe-S and Fe-C-P phase diagrams show the existence of this low melting phase. The effect of these elements on hot tearing in ferrous metals has been well established for some time.

Heat Treatment — Equilibrium phase diagrams are extremely important in determining the heat treatability of various alloys. This subject will be discussed only briefly in this article.

A study of the diagrams will indicate what compositions are heat treatable, and what temperatures and types of cooling should be employed. The equilibrium diagram in Fig. 1 shows that compositions between 100 per cent A and X and Y and 100 per cent B can be hardened by solution heat treatment and age or precipitation hardening because of the decreasing solid-solubility of β in α and α in β.

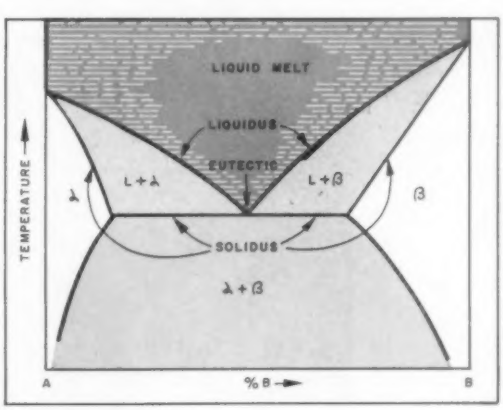


Fig. 10 — Hot tearing is increased with increasing liquidus - solidus spread and with increasing amount of contraction during solidification. It is reduced with increasing amount of eutectic

The treatment would consist of heating the metal into the single solid solution field (although generally below the eutectic temperature to avoid possible nonequilibrium eutectic melting) rapidly cooling into the two phase $\alpha + \beta$ region and aging at room temperature or accelerating the precipitation of the hardening phase by heating the alloy above room temperature without leaving the two phase field. The strength of the Al-Cu, Al-Mg, and Cu-Be alloys, for example, are obtained in this manner.

In addition, eutectoid transformations, such as occur in the Fe-C and Cu-Al systems, indicate that quenching is capable of hardening the metals. Eutectoid transformations appear similar to eutectics but involve the transformation of a solid solution into two different solid phases.

REFERENCES

1. H. F. Taylor, E. A. Rominski, and C. W. Briggs, "Fluidity of Ingot Iron and Carbon and Alloy Cast Steels," *Transactions*, AFS, Vol. 49, 1941 p. 1.
2. S. Floreen and D. V. Ragone, "The Fluidity of Some Aluminum Alloys," *Transactions*, AFS, Vol. 65, 1957, p. 391.
3. I. C. H. Hughes, "Solidification Sequences and Their Significance," *Journal of Research and Development*, BCIRA, Vol. 5, 1955, p. 518.
4. R. W. Ruddle, *The Solidification of Castings*, Institute of Metals, 1957.
5. E. Scheil, "Inoculation and Inoculants in Metal Melts," *Giesserei*, Vol. 43, Jan. 19, 1956, p. 33.
6. J. L. Walker, "Structure of Ingots and Castings," *Liquid Metals and Solidification*, ASM, 1958, p. 319.
7. W. S. Pellini, "Solidification of Various Metals in Ingot and Sand Molds," *Electric Furnace Steel Proceedings*, AIME, Vol. 14, 1956, p. 48.
8. D. C. G. Lees, "The Hot Tearing Tendencies of Aluminum Casting Alloys," *Journal*, Institute of Metals, Vol. 72, 1946, p. 343.
9. H. F. Bishop, C. G. Ackerlind, and W. S. Pellini, "Investigation of Metallurgical and Mechanical Effects in the Development of Hot Tearing," *Transactions*, AFS, Vol. 65, 1957, p. 247.
10. H. F. Bishop, C. G. Ackerlind, and W. S. Pellini, "Metallurgy and Mechanics of Hot Tearing," *Transactions*, AFS, Vol. 60, 1952, p. 818.

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Aluminum and

● AN IMPORTANT BIT of information that can be obtained from the proper appraisal of an equilibrium phase diagram is how different alloy compositions might be expected to behave when cast in a mold. By proper appraisal is meant consideration of the fact that the equilibrium conditions depicted by a phase diagram do not represent the nonequilibrium conditions that will prevail during solidification of a casting.

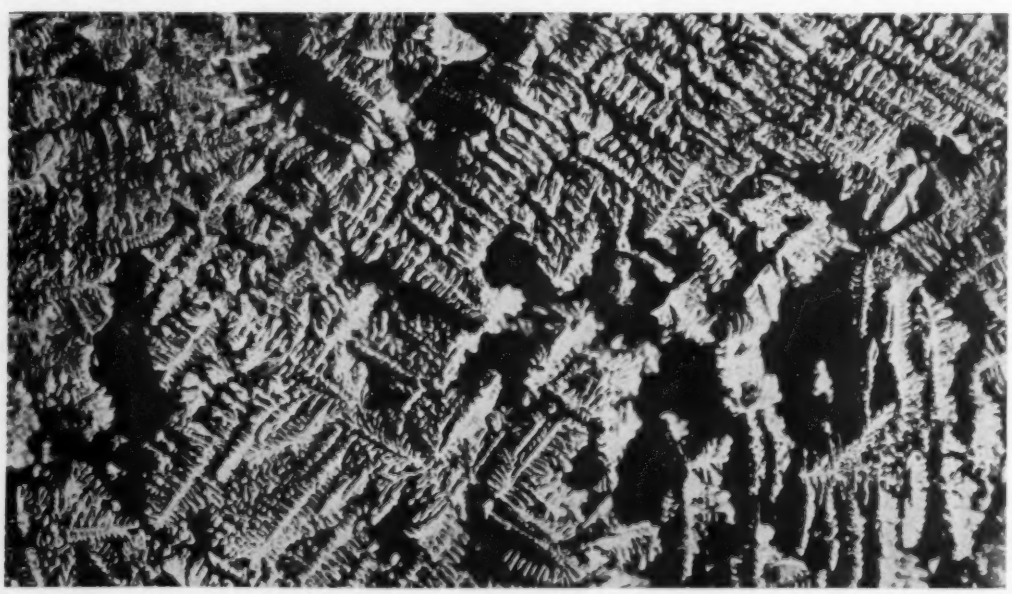
If allowance is made for this difference, some good estimates of casting characteristics can be obtained from examination of phase diagrams alone. If the information provided by phase diagrams is supplemented by cooling curve data for specific alloys, even more precise estimates of the effect of alloy composition on casting characteristics can be gained, especially with alloys containing more than one alloying element.

The Role of Fluidity—The casting characteristics which will be discussed are feeding ability, resistance to hot cracking, and fluidity. Possibly, the least important of these for most applications is fluidity or mold filling capacity since deficiencies in this characteristic can be overcome, to a large extent, by an increase in pouring temperature and by proper gating. However, fluidity can be an important factor in pouring thin-walled castings, particularly if the rate of solidification is rapid.

Comparisons of fluidity often are made on the basis of the same pouring temperature for different alloys. These alloys will have different liquidus temperatures, and the number of degrees of superheat, which is the difference between the liquidus and pouring temperatures, will vary accordingly. Since the amount of superheat is related directly to fluidity, the relative fluidities of the alloys will vary with the different superheat values.

However, the amount of eutectic or low melting phases formed during solidification also affect fluidity,

Fig. 1—Aluminum alloy dendritic structure developed during solidification



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Magnesium Alloys

and alloys which are cast with the same number of degrees of superheat will differ in fluidity because of differences in the quantities of eutectic or similar material formed. An illustration of similar material would be the two constituents which solidify simultaneously over a range of temperatures in ternary alloys just prior to the separation of the ternary eutectic. It is thought that these materials solidify in much the same, nondendritic manner as a eutectic. As would be expected, with the same amount of superheat, the more eutectic or similar low melting material formed during solidification, the higher the fluidity of an alloy will be.[1, 2, 3]

Principal Factors—The solidification range and the amount of eutectic or similar low melting phases formed during solidification are the principal factors affecting inherent casting characteristics of an alloy. Solidification characteristics of an aluminum alloy which contribute to good feeding ability are a relatively small solidification range with about 40 to 80 per cent by volume of eutectic or similar material formed during the last stages of solidification.

As pointed out in Prof. Wallace's article on Page 84 of this issue, a concentrated, center line type of unsoundness is most likely to be encountered in castings poured with a pure metal or an alloy of eutectic composition. Although this type of unsoundness is less detrimental to mechanical properties than more scattered shrinkage, generous risering and a substantial temperature gradient between the risers and the portions of the casting farthest from the risers are necessary to eliminate entirely this concentrated shrinkage. This type of unsoundness also is more likely to be encountered with alloys which form more than about 80 per cent eutectic or similar material than with alloys which form smaller quantities of these constituents.

With aluminum alloys which form progressively less than about

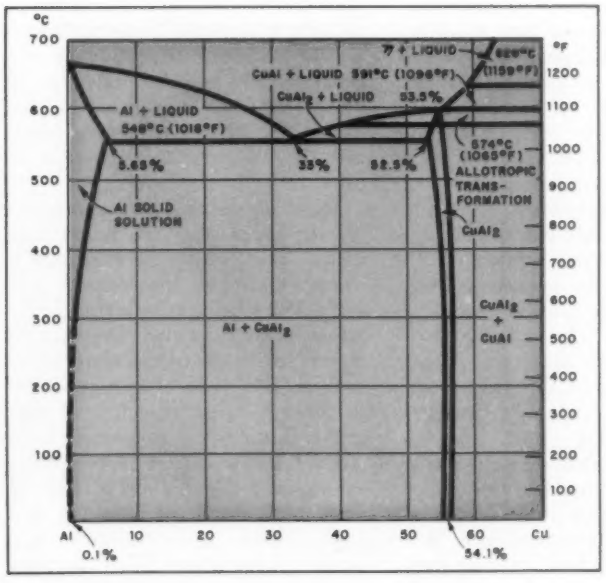
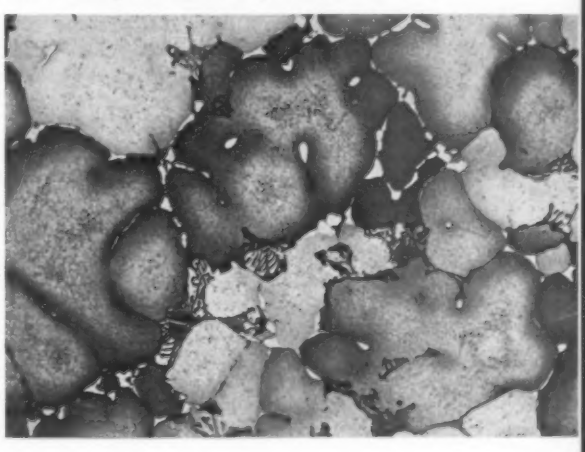


Fig. 2—Aluminum end of the aluminum-copper equilibrium diagram

Fig. 3—As-cast microstructure of an alloy 195 sand casting. Keller's etch, 100 X



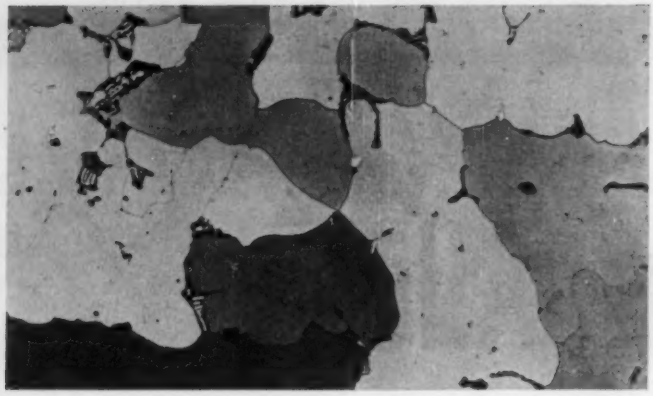


Fig. 4—Microstructure of an alloy 195-T4 sand casting. Keller's etch, 100 X

40 per cent eutectic and similar material during solidification, there is a small but progressive loss in feeding ability which becomes poorest when the alloy composition is reached at which no eutectic is formed and the solidification range is largest for that alloy system. However, all solid solution type alloys which form no eutectic during solidification have relatively poor feeding characteristics even when the solidification range is substantially less than the maximum for that system.

Effect of Dendrites—Fig. 1 shows the dendritic structure of an aluminum alloy. If solidification consists entirely of the formation and growth of dendrite arms as is the case with a solid solution alloy, liquid feed metal has difficulty in penetrating the narrow channels which remain between the dendrite arms during the last stage of solidification. This is true to a considerable extent even when the solidification range and the accompanying extent of the mushy zone in a solidifying casting are appreciably less than the maximum for that alloy system.[4, 5]

The resistance to hot cracking follows much the same pattern as the tendency for interdendritic shrinkage, although very small quantities of eutectic do not appear to be helpful.[3, 6] As solidification progresses, the interlocking dendrites become coherent before solidification is complete. If there is a relatively large temperature drop from the time the alloy becomes coherent and final solidification takes place, considerable stress will be exerted on the coherent dendrites because of the contraction that occurs in the coherent material during this reduction in temperature. Substantial resistance to this contraction will cause cracking, particularly in local hot spots where solidification has not progressed as far as in surrounding areas.

As the quantity of eutectic solidifying in an alloy at constant temperature becomes greater, the temperature drop and resultant stresses become smaller from the time the alloy becomes coherent until solidification is complete. Also, as the quantity of this type material formed in an alloy increases, the alloy tends to become coherent at a progressively later stage of solidification because of the nondendritic nature of eutectic solidification, and cracks may be filled with eutectic material. Accordingly, the resistance to hot cracking becomes greater as the quantity of eutectic and similar material formed becomes larger.

Other factors which probably influence resistance to hot cracking are the mode of crystal growth and the mechanical properties, particularly the ductility of the interlocking dendrites after they have become coherent. Not too much is known about these factors, but it is thought that they contribute to differences in the hot cracking resistance of alloys from different systems which cannot be explained entirely on the basis of solidification characteristics. The relative proportions of the different phases formed and the solidification range, can be estimated from examination of phase diagrams.

Heat Treatment—Binary phase diagrams also provide information regarding susceptibility of different alloys to heat treatment and permissible solution heat treating temperatures for binary alloys.[7] The mechanical properties of many aluminum alloys can be improved by solution heat treatment at a temperature about 15 to 20° F below the solidus temperature followed by a quench to retain the dissolved alloying elements in solid solution. The temper designation for this treatment is T4. The time of solution treatment usually is 8 hr for permanent mold castings and 12 hr for sand castings. A hot or boiling water quench generally is used.

An alloy is in an unstable condition after a T4 heat treatment and some of the excess alloying elements precipitate slowly from solution at room temperature. This precipitation is greatly accelerated at temperatures of 300° F or higher. The higher the aging temperature employed, the more rapidly precipitation will take place, and, in general, the coarser the precipitate that forms and the lower the combination of properties that can be attained.

Aging initially increases the strength and hardness of an alloy and reduces the elongation if the temperature used is not unduly high. A T6 temper designation indicates that an alloy has been solution heat treated and aged at a temperature generally between 300 and 350° F for about 3 to 5 hr to provide a desirable combination of relatively high strength and acceptable elongation. If this type of aging treatment is extended to provide even higher strength and hardness, a T61 or T62 designation is used.

Internal stresses and potential growth in castings are reduced as aging temperature is increased. When maximum dimensional stability of a casting is important, particularly for elevated temperature service, a higher temperature aging treatment, often in the range of 400 to 500° F, is employed. If this aging treatment is performed on a part in the as-cast or F condition, the temper designation is T5. If such high temperature aging follows solution heat treatment, the temper is designated T7. The term

potential growth refers to the slight increase in the dimensions of a part that occurs when alloying elements precipitate from solid solution in certain alloys.

Al-Cu Alloys—Fig. 2 shows the aluminum end of the Al-Cu equilibrium diagram.[8] The aluminum alloys from this system were the first to be used in the heat treated condition. Most of the aluminum and magnesium binary systems from which commercially important heat treatable alloys are taken are of this general type; that is, the alloying element is completely soluble in the liquid state and partially soluble in the solid state.

There usually is a significantly higher solubility of the alloying element at the eutectic temperature than at room temperature. In most systems a eutectic is formed between the aluminum solid solution and an intermetallic phase. In the Al-Cu system, the eutectic is composed of a mixture of about 40 per cent aluminum solid solution and 60 per cent intermediate Al-Cu phase corresponding approximately to the composition $CuAl_2$. These proportions are determined by the lever law.

What are the features of this particular diagram which may be desirable from one standpoint or undesirable from another? The fact that about 5.65 per cent Cu is soluble in aluminum at the eutectic temperature and only 0.1 per cent Cu is soluble at room temperature would indicate that Al-Cu alloys would respond well both to solution heat treatment and precipitation heat treatment.

Alloys containing intermediate copper contents, particularly in the vicinity of 5.65 per cent, would have relatively large solidification ranges according to differences in temperatures of the liquidus and solidus curves shown here. Since the solidus curve is shifted to the left under nonequilibrium casting conditions, alloys containing less than 5.65 per cent Cu will have appreciably larger solidification ranges than would be indicated by the phase diagram.

How Much Copper?—Since the intermetallic compound $CuAl_2$ is hard and brittle, and the major portion of the eutectic consists of this compound, the copper content of an alloy must be less than 5.65 per cent if relatively high elongations are to be obtained in the heat treated condition. As a matter of fact, 4.5 to 5 per cent is about the maximum amount of copper which can be taken into solution without resorting to an unduly long solution heat treatment. Also, because of the brittle nature of the eutectic, it is not desirable to use sufficient copper in aluminum alloys to form large amounts of eutectic and, at the same time, reduce the solidification range substantially. Accordingly, attainment of the type of solidification which would assure good casting characteristics for Al-Cu alloys is limited by features of the equilibrium diagram that determine the composition and properties of the eutectic.

Essentially binary Al-Cu casting alloys are less important today than formerly although copper is an important alloying element in ternary and even more complex casting alloys as well as in wrought alloys. Alloy 195 contains a nominal 4.5 per cent Cu. According to the equilibrium diagram it should solidify

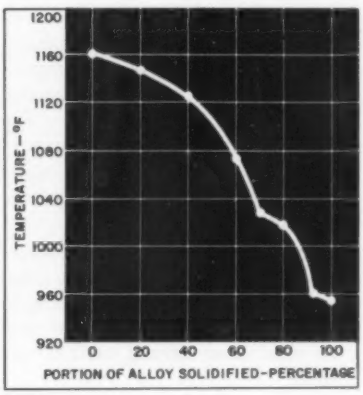


Fig. 6—Alloy 108 solidification curve plotted with data from cooling curve in Fig. 5

Fig. 5—Alloy 108 cooling curve. Dashed lines were used to determine relative proportions solidified at different temperatures

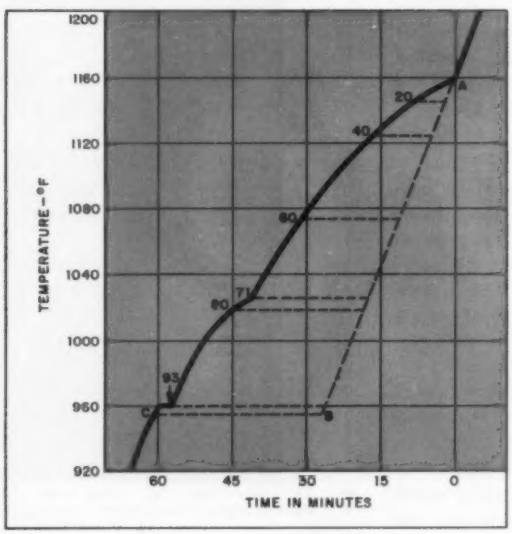
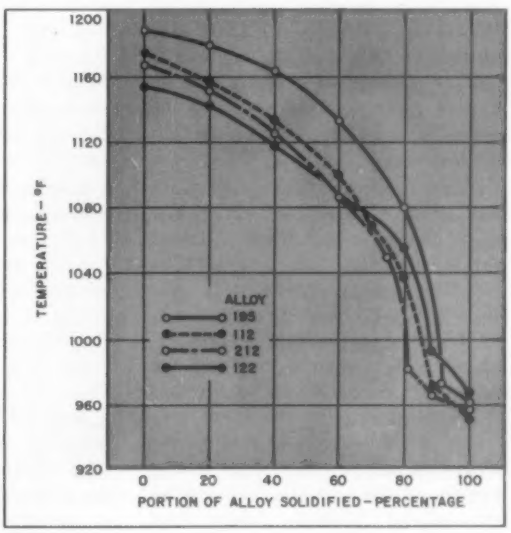


Fig. 7—Curves show relative proportions of alloys solidifying at different temperatures



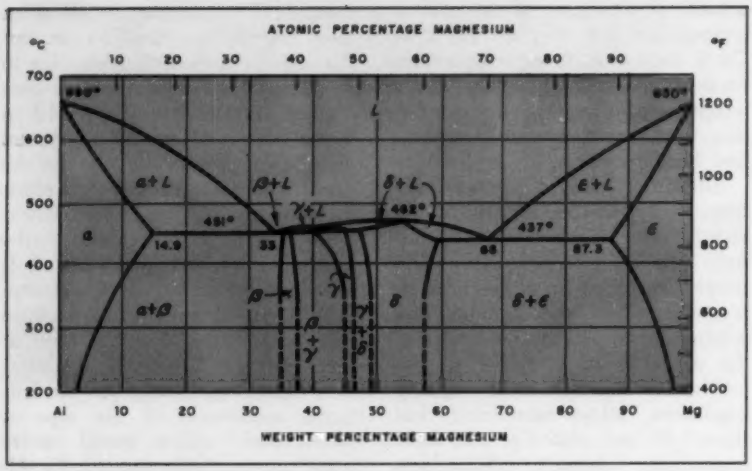


Fig. 8—System Al-Mg equilibrium diagram. Similarities of the Mg and Al ends of diagram indicate like solidification and casting characteristics

entirely as primary aluminum solid solution. However, under nonequilibrium casting conditions, the solidus line would be shifted considerably to the left and some eutectic would be formed.

Since eutectic will be formed in this alloy, the solution heat treating temperature will have to be lower than the eutectic temperature of 1018° F. Actually, 195 alloy contains small quantities of iron and silicon and the solidus temperature is appreciably lower than 1018° F. The maximum safe solution heat treating temperature for ternary or more complex alloys containing copper can be determined by heating curves which are the reverse of cooling curves or by data obtained by heating specimens at various temperatures to learn the minimum temperature at which eutectic melting or burning occurs. A safe heat treating temperature generally is 15 to 20° F below this temperature.

Avoid Eutectic Melting—Eutectic melting must be avoided chiefly because the expansion of this material in changing from the solid to the liquid state distorts the surrounding solid metal and small voids are formed when the eutectic subsequently solidifies. This, of course, has an adverse effect on tensile properties.

Fig. 3 shows the microstructure of as-cast alloy 195. The Al-Cu portion of the eutectic appears as light-colored globules along the grain boundaries. The aluminum-rich constituent of the eutectic tends to deposit on the dendrites already formed, leaving Al-Cu as moderately large particles in the interstices.[5] The coring or variation of composition within the grains is revealed by variations in shading. The areas of higher copper content near the outside of the grains are darker than the low-copper areas in the center of the grains.

Fig. 4 shows the microstructure of alloy 195-T4. Solution heat treatment has dissolved practically all of the Al-Cu constituent and has eliminated coring within the grains.

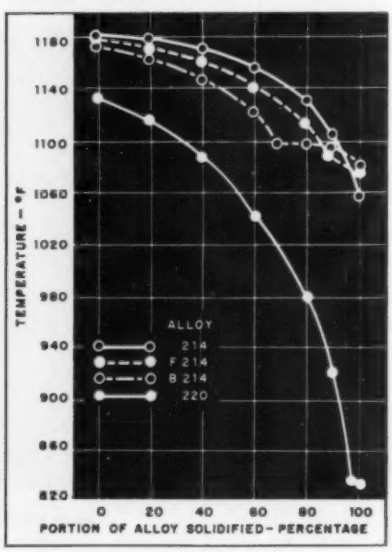
Alloys containing more than 5.65 per cent Cu are used to a limited extent where high elongation is less important than high hardness or improved properties at elevated temperature which is provided by undissolved Al-Cu. Alloys 112, 113, 212 and 122 containing 7 to 10 per cent Cu are in that category.

Cooling Curve Data—More precise information about the phases which form and the relative proportions of each is provided by cooling curves.[3] The solid line shown in Fig. 5 is a cooling curve for alloy 108 which contains a nominal 4 per cent Cu and 3 per cent Si. The alloy starts to solidify at point A and solidification is complete at point C. A mixture of aluminum solid solution and silicon similar to the eutectic in an Al-Si alloy starts to solidify simultaneously at the point marked with the number 71 and ends at number 93 where the ternary eutectic starts to solidify. This mixture of aluminum solid solution and silicon, which usually forms over a range of temperatures in a ternary or more complex alloy before the eutectic, has been mentioned previously as being quite similar to a eutectic in mode of solidification and in the accompanying beneficial effect it has on casting characteristics.

The dashed curve AB is a smooth curve drawn so that the slope of the upper portion is that of the alloy 108 curve above the liquidus temperature A and the slope of the lower portion is the same as the 108 curve below the solidus curve C. Thus, AB is a hypothetical cooling curve representative of conditions that would prevail if no heat of fusion were liberated during solidification. If it is assumed that the heat of fusion of successively solidifying portions of the alloy is the same, then the percentage of the total displacement from line AB at any point on the cooling curve would represent the percentage of the alloy which had solidified at that point.

For example, the horizontal line connecting the point marked 20 with AB is just 20 per cent of the length of line BC. Thus, 20 per

Fig. 9—Solidification curves for alloys 214, 220, and for two variations of 214



cent of the alloy should have solidified at that point. The other points on the cooling curve were determined in the same manner and these selected points were used to plot what is termed a solidification curve in which the portion of an alloy that has solidified is plotted against temperature.[3] Actually, there probably is some variation in the heats of fusion of successively solidifying portions of an alloy, but the variation should not be sufficiently large to alter seriously the value of solidification curves on a comparative basis.

Replot the Data—Fig. 6 shows the 108 alloy solidification curve plotted from these data. Such curves permit a somewhat easier interpretation of the manner in which an alloy solidifies than the original cooling curves.

Fig. 7 shows solidification curves for alloys in which copper is the principal alloying element. The top curve is for alloy 195 which has the lowest copper content and the largest solidification range. Because of the wide solidification range and the small amount of eutectic formed, the alloy has only mediocre feeding characteristics. The relatively large drop in temperature during the last stages of solidification, plus the small amount of eutectic formed, would account for the poor hot cracking resistance of this alloy.

The other solidification curves shown here are for 7 to 10 per cent Cu alloys which have successively lower liquidus temperatures and smaller solidification ranges. The other features of these curves such as the quantity of eutectic and binary phases formed also are more favorable than with 195, but the degree improvement is small, and these alloys have only a little better feeding ability and resistance to hot cracking than 195.

Al-Mg Alloys—The Al-Mg equilibrium diagram is shown in Fig. 8.[9] Magnesium has high solubility in aluminum at the eutectic temperature and reasonably high solubility at much lower temperatures. Even at room temperature, the solubility is well over 1 per cent. This permits alloys with up to about 7 per cent Mg to retain most of this element in solid solution with the rate of cooling encountered in casting production. Thus, no solution heat treatment is required with alloys such as 214 containing 3.8 per cent Mg and Almag 35 containing about 7 per cent Mg.

With higher magnesium contents, such as 10 per cent in 220 alloy, solution heat treatment is required. The solidus curve in the diagram is shifted enough to the left during nonequilibrium solidification in a casting so that some eutectic is formed. The magnesium in this eutectic plus other magnesium which precipitates during cooling to room temperature must be taken into solution. Since 220 is a relatively high purity binary alloy, the eutectic shown in this diagram is the lowest melting phase and a solution heat treat temperature just under 840° F, which is the eutectic temperature shown here, is satisfactory.

With the shift in the solidus curve that occurs under actual casting conditons, alloys 220 and Almag 35 would be expected to have very large solidification ranges and poor feeding ability.

Alloys containing much more than 10 per cent Mg are not used because of the brittleness of the Al-Mg intermediate compound, corresponding approximately to the compositon Mg_5Al_8, which is formed. The eutectic contains about 90 per cent of this brittle constituent in combination with only 10 per cent aluminum solid solution. Also higher magnesium contents cause more room temperature aging to occur, following solution heat treatment, which reduces elongation values. As a matter of fact, contrary to the usual effect, any substantial amount of precipitation hardening is undesirable in the high magnesium alloys. Apparently, the preferential distribution of this brittle precipitate along grain boundaries reduces ductility.

Al and Mg Are Similar—The general similarity of the magnesium end of the diagram to the aluminum end indicates similar solidifi-

Fig. 11—System Al-Si, aluminum end of the equilibrium diagram. No intermetallics are formed

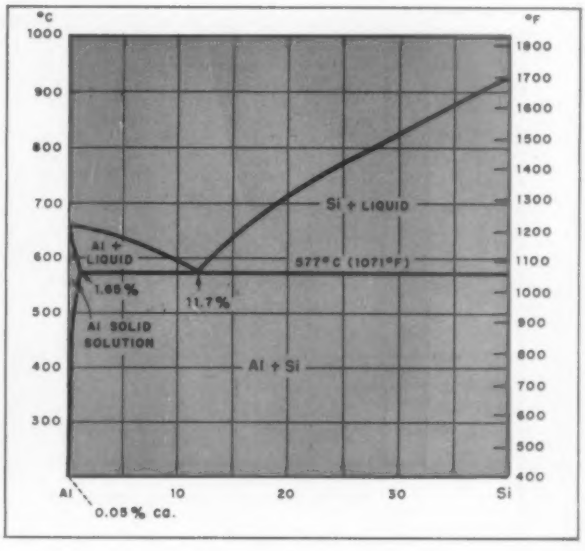
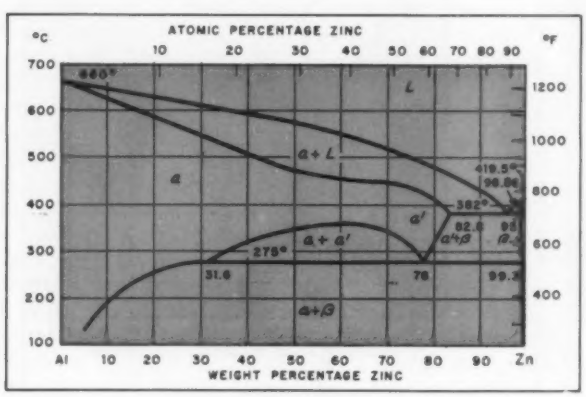


Fig. 10—System Al-Zn equilibrium diagram helps to explain characteristics of the Al-Zn-Mg alloys



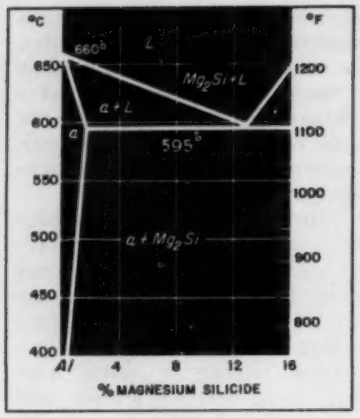


Fig. 12 — Al-Mg_2Si, aluminum end of the equilibrium diagram

cation and casting characteristics.

Fig. 9 shows solidification curves for alloys 214, 220, and two variations of 214. Alloy 220 has poor feeding characteristics because of the large solidification range and small amount of eutectic formed. Interdendritic microporosity tends to be formed and the same is true of alloy 214 which, although the solidification range is shorter, forms no eutectic to aid in feeding. Other Al-Mg alloys such as Almag 35 also have poor feeding ability.

Microradiographs of cast Al-7 per cent Mg alloy show the interdendritic nature of the microporosity. Not only is the feeding distance from risers short in alloys subject to microporosity, but this type of unsoundness is more damaging to properties than more rounded and localized shrinkage porosity. Also, gas accentuates microporosity and alloys subject to this defect should be thoroughly degassed before pouring.

Alloy 220 might be expected to have as poor resistance to hot cracking as 195 from the similarity in the shapes of the solidification curves but 220 is considerably better in this respect than 195. This undoubtedly is associated with differences in the mode of crystal growth and mechanical properties of the dendrites after they have become coherent.

Alloy F214 contains 0.5 per cent Si and B214 contains 1.8 per cent Si in additon to 3.8 per cent Mg. Silicon was added to these alloys to form Al-Mg_2Si eutectic and provide the improved casting characteristics associated with this type of solidification. The mode of solidification of this eutectic, however, does not favor improvement in feeding ability as much as the Al-Si eutectic.

As would be expected, alloy 220 with the largest magnesium content has the highest tensile properties of these alloys. In fact, alloys with magnesium contents of this order have the best combination of tensile strength and elongation of any commercial sand-cast aluminum alloys.

Alloy X250 recently was introduced by Alcoa as an improvement over 220 in two respects, namely, much better resistance to stress-corrosion cracking with a full boiling water quench and considerably less room temperature aging, which, as mentioned before, has an adverse effect on elongation. This alloy contains 8 per cent Mg and 1½ per cent Zn plus small additions of other alloying elements.

Al-Zn-Mg Alloys—Fig. 10 shows the Al-Zn equilibrium diagram.[9] Al-Zn alloys no longer are used commercially, but Al-Zn-Mg alloys are used, and this diagram helps to explain their characteristics. Alloys of this type are A612, C612, 40E, and those identified as Ternalloys. It will be noted that zinc has an extremely high solubility in solid aluminum, and the eutectic is at 96 per cent Zn. Small additions of magnesium do not substantially change the solidification characteristics indicated by this diagram.

Alloys containing substantial quantities of zinc solidfy almost entirely by the formation of primary solid solution crystals with no eutectic formed. Consequently, the Al-Zn-Mg alloys have poor feeding characteristics and are subject to microporosity similar to that encountered in the Al-Mg alloys.

Fig. 13—Curves show relative proportions of alloys solidifying at different temperatures

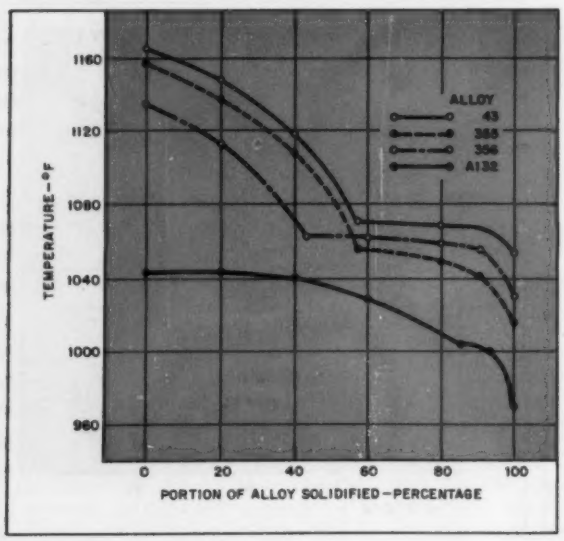
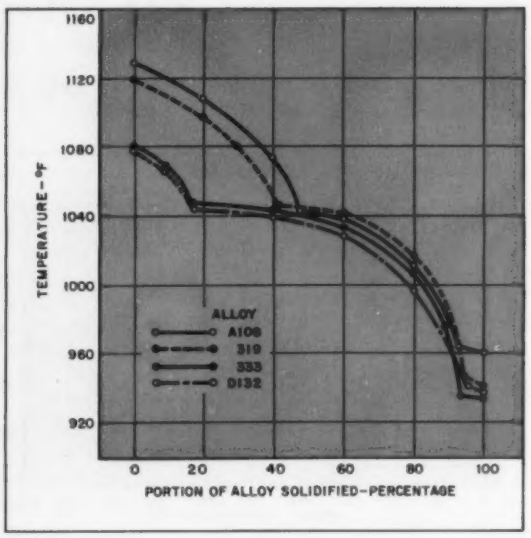


Fig. 14—Curves show relative proportions of alloys solidifying at different temperatures



These alloys also have only fair resistance to hot cracking. The high solubility of zinc in solid aluminum down to relatively low temperatures, as was the case with magnesium, is evidence that substantial quantities of these elements will be retained in solid solution in a casting. Accordingly, some of these alloys do not require heat treatment. With increased zinc and magnesium contents, however, solution heat treatment may be used. These alloys age rapidly at room temperature, and artificial aging treatments sometimes are employed to provide more stable mechanical properties.

Al-Si Alloys—Fig. 11 shows the partial Al-Si equilibrium diagram.[8] Silicon is the most important element added to aluminum alloys from the standpoint of casting characteristics. In other systems, relatively large additions of alloying element would be required to form any substantial amount of eutectic, and the eutectic formed would consist of a larger proportion of brittle intermetallic compound than aluminum solid solution. Such is not the case in the Al-Si system.

Although only part of the diagram is shown here, no intermetallics are formed and the eutectic consists of only about 10 per cent Si distributed in a ductile aluminum solid solution matrix making up about 90 per cent of this material. In contrast, it will be recalled that the eutectic in the Al-Mg system consists of almost 90 per cent brittle intermetallic compound and the eutectic in the Al-Cu system contains about 60 per cent brittle intermetallic compound. It is not surprising, therefore, that the eutectic formed in Al-Si alloys is so much less harmful to ductility.

The solubility of silicon in solid aluminum is relatively low and binary Al-Si alloys are not heat treated. Solution heat treatment will increase properties to a small extent, but higher properties, if needed, can be obtained more readily by the addition of other alloying elements. Also, the binary alloys are not susceptible to precipitation hardening after a solution heat treatment. When high tensile properties are not needed, alloy 43 containing 5 per cent Si is used for many parts because of its good castability and pressure tightness. The only other binary composition of any importance is alloy 13 containing 12 per cent Si and used in diecastings.

Both magnesium and copper are used along with silicon to provide alloys which can be heat treated for higher properties. Neither element, in the quantities generally used, offsets the beneficial effect of silicon on casting characteristics.

Before considering some solidification curves, it might be helpful to examine the partial Al-Mg_2Si diagram in Fig. 12.[9] Mg_2Si forms a quasi-binary system with aluminum and explains the pronounced hardening effect of small quantities of magnesium when used in conjunction with silicon. A maximum of 1.85 per cent Mg_2Si is soluble in aluminum and this compound is susceptible to both solution and precipitation hardening effects. Since it is difficult to dissolve much more than 1 per cent of this compound at the solution heat treating temperatures which can be used, the quantity of magnesium used in Al-Si alloys generally is small.

Solidification Characteristics—Fig. 13 shows the solidification characteristics of alloys containing different quantities of silicon and other elements. The top curve is for 43 alloy containing 5 per cent Si. This curve exhibits the characteristics which contribute to good castability. The solidification range is not unduly large and over 40 per cent eutectic is formed at a nearly constant temperature.

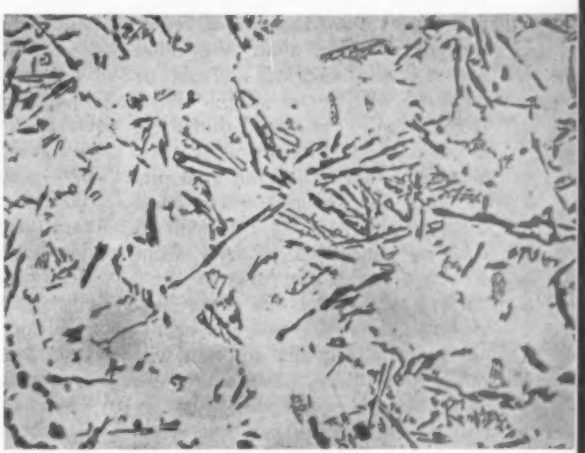


Fig. 15—Normal microstructure of an Al-7 per cent Si alloy sand casting; 0.5 per cent HF etch; 100 X

Alloy 355 also contains 5 per cent Si plus 1.25 per cent Cu and 0.5 per cent Mg. Its solidification characteristics are similar to those of alloy 43 except that the eutectic type material separates at lower temperatures and over a greater range in temperature. Alloy 356 contains 7 per cent Si and 0.3 per cent Mg. The higher silicon content reduces the liquidus temperature and results in the formation of a larger amount of eutectic material.

Alloy A132 is essentially of eutectic composition with regard to silicon but also contains small quantities of copper, magnesium, and nickel. In this alloy, solidification occurs over such a narrow temperature range that the piping type of shrinkage mentioned earlier is likely to be encountered without generous risering and steep solidification gradients. A132 is the original Lo-Ex alloy, and it should be mentioned that silicon has the desirable effect of reducing the coefficient of expansion of aluminum alloys as well as the volume change in going from the liquid to the solid state.

Fig. 14 shows solidification curves for alloys containing about 3 to 4 per cent Cu in addition to silicon. Alloy A108 contains about 5.5 per cent Si and 4.5 per cent Cu while 319 contains a little more silicon and a little less copper. Accordingly, more of the 319 solidifies as aluminum solid solution and silicon, and less as ternary eutectic in comparison with A108. It will be

recalled that two constituents, such as aluminum solid solution and silicon, which solidify simultaneously over a range of temperatures prior to the eutectic, are thought to deposit in much the same nondendritic manner as the eutectic and, therefore, are similarly beneficial to feeding.

Alloys 333 and D132 are very similar in composition, both containing about 9 per cent Si and 3.5 per cent Cu plus small quantities of other elements. Both exhibit similar solidification characteristics. These higher silicon alloys are used chiefly for permanent mold castings in which a deficiency in feeding will result in a concentrated center shrinkage rather than the more scattered shrinkage that would be obtained with lower silicon alloys. It is generally recognized that there is less latitude in controlling temperature and solidification gradients in permanent mold than in sand castings, and it is more difficult to eliminate shrinkage entirely from certain areas of a casting.

Effect of Sodium—In alloys containing substantial amounts of silicon, a small sodium addition will refine the silicon particles in the eutectic. The unmodified microstructure of an Al-7 per cent Si alloy casting is shown in Fig. 15 and the same alloy after modification with sodium is shown in Fig. 16. This refinement provides some improvement in the properties of slowly solidified castings, but the principal benefit is in feeding characteristics of both sand and permanent mold castings. Apparently, the smaller silicon particle size permits a freer flow of liquid metal during eutectic solidification, although this does not explain entirely the beneficial effect of modification on feeding since the further reduction in silicon particle size caused by sodium may be relatively small in rapidly cooled permanent mold castings. The indirect effect of modification on mechanical properties may be marked because of the improved feeding provided by this treatment.

Some experimental interest currently is being shown in hypereutectic Al-Si alloys containing 16 to 25 per cent Si. These relatively high silicon contents improve the wear resistance. The current interest is exhibited chiefly by automotive companies for parts where the light weight or good thermal conductivity of aluminum also would be an advantage. These alloys are not new but have been little used chiefly because of machining difficulties.

Silicon crystals are the primary phase in these alloys, and these crystals normally are quite large as shown in Fig. 17 unless solidification is very rapid. These primary silicon crystals also tend to segregate in a casting. Introduction of a small amount of phosphorous into a melt will refine the primary silicon as shown in Fig. 18. This refinement reduces segregation and improves machining characteristics substantially although carbide tools still must be used.

Grain Refinement—Titanium or titanium plus boron generally is used to grain refine aluminum alloys. Solid solution type alloys from the Al-Cu, Al-Mg, and Al-Zn-Mg systems are relatively easy to grain refine while alloys containing substantial quantities of silicon are more difficult to refine. Apparently, the primary dendrite arms grow more rapidly into the surrounding liquid as the degree of enrichment in alloying elements such as silicon is increased. Thus, in the higher silicon alloys, the first dendrites which are nucleated in any region of the casting tend to form large skeletons rather quickly and thereby prevent the nucleation of other grains near the original ones.

Grain refinement has little inherent effect on the mechanical properties of aluminum alloys. As was the case with sodium modification of Al-Si alloys, the principal benefit of grain refinement is improvement in feeding characteristics of all aluminum alloys. The mechanics of this improved feeding are not clearly understood although it is sometimes associated with the greater ease with which small dendrites can move in a partially solidified alloy. This mass movement of dendrites could reduce the need for liquid feeding.

As with modification, grain refinement may indirectly improve tensile properties as a result of the improved feeding provided and as

Fig. 16—Same alloy as Fig. 15 after modification with sodium; 0.5 per cent HF etch; 100 X

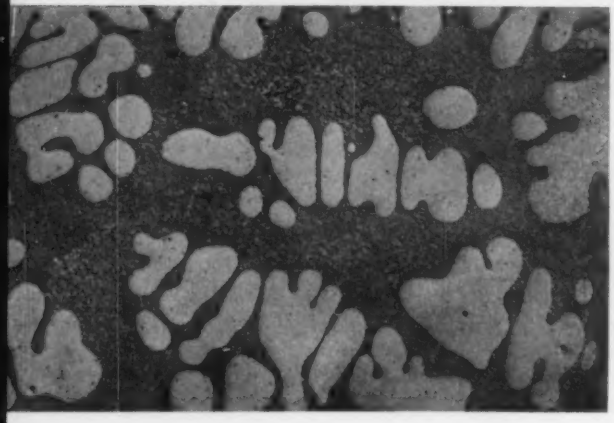
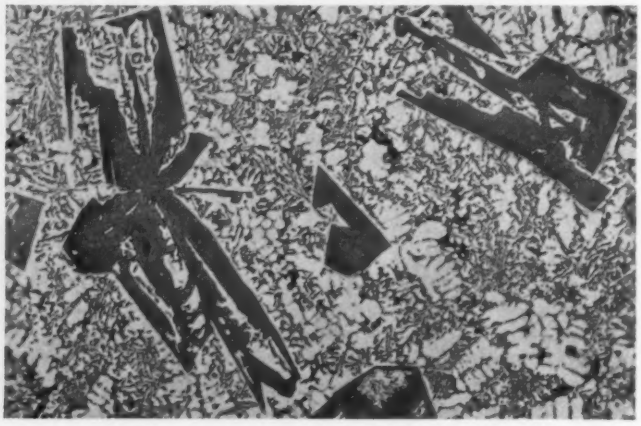


Fig. 17—Microstructure of chill-cast Al-21 per cent Si alloy; 0.5 per cent HF etch; 100 X



a result of the change in the form and distribution of gas porosity. The individual voids are small and isolated in fine-grained castings but are larger and elongated along the grain boundaries in coarse-grained castings, particularly in solid solution type alloys. Grain refinement also has a pronounced effect in improving resistance to hot cracking.

Another effect of grain refinement whether attained by nucleating agents or by rapid solidification is to reduce the time needed to dissolve all alloying elements during solution heat treatment. This effect is associated with the shorter distance through which diffusion must take place in a fine-grained casting as well as the reduced size of the soluble constituents in the eutectic.

Solidification Rate—The rate of solidification of most aluminum alloys affects the tensile properties of sound castings. If feeding is good in every case, the faster the rate of solidification, the higher are the properties in the casting. This is associated with finer insoluble constituent size, finer grain size, and reduced gas porosity as well as smaller and more isolated voids with higher rates of solidification.

As already mentioned, it is more difficult to ensure favorable solidification gradients in permanent mold than in sand castings where chills or insulating material may be used where needed to provide the desired gradients. Accordingly, the mechanical properties of solid solution alloys which have poor inherent feeding characteristics may be benefited less in going from sand to permanent mold castings than is the case with alloys which have good feeding characteristics.

Mg-Al and Mg-Al-Zn Alloys—In considering magnesium-base alloys, the magnesium end of the Al-Mg equilibrium diagram in Fig. 8 might be examined first. This end of the diagram is very similar to the aluminum end and the same type of solid solution solidification with very little eutectic formation is obtained with alloys containing aluminum as the major alloying element. Fig. 19 shows solidification curves for alloys AM100A containing 10 per cent Al and AZ92A containing 9 per cent Al and 2 per cent Zn.

The large solidification range and the general similarity to the earlier curve for alloy 220 in Fig. 9 will be noted. Accordingly, the Mg-Al and Mg-Al-Zn alloys also have poor feeding characteristics and are subject to interdendritic microporosity. Resistance to hot cracking is only fair. Alloys containing a sizable amount of aluminum and a small quantity of zinc are the most important commercially. Alloys of lower aluminum content and higher zinc content such as AZ63A containing 6 per cent Al and 3 per cent Zn have even poorer feeding characteristics.

Heat Treatment of Mg Alloys—The heat treatment of magnesium alloys[10] is similar to that of aluminum alloys, and the same temper designations are used. Solution heat treatment temperatures are normally in the range of 720 to 1050° F depending upon the composition, and the time of treatment may be as long as 24 hr. Magnesium is a very reactive metal, and a protective atmosphere, usually sulfur dioxide, must be used in the solution heat treating furnace.

Magnesium alloys of high aluminum and low zinc content are susceptible to germination which is the growth of large grains in some locally stressed areas of a casting during solution heat treatment. Germination is very detrimental to properties and may reduce tensile and yield strength 50 per cent or more. The conditions favoring germination are a very fine grain size, the presence of internal stresses such as occur in chilled areas, complete or nearly complete solution of grain boundary constituents, and a heat treating temperature above 730° F.

Fig. 19 — Solidification curves show relative proportions of alloys solidifying at different temperatures

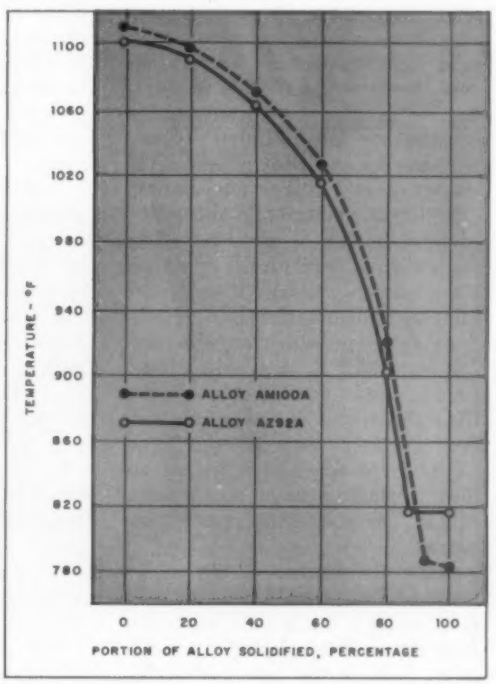
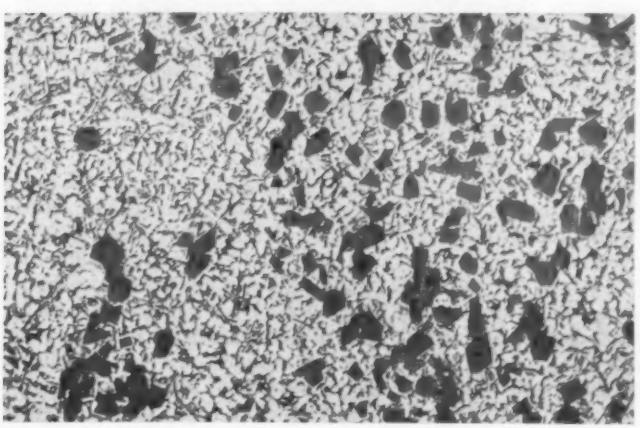


Fig. 18—Same alloy as Fig. 17 after treatment with phosphorus; 0.5 per cent HF etch; 100 X



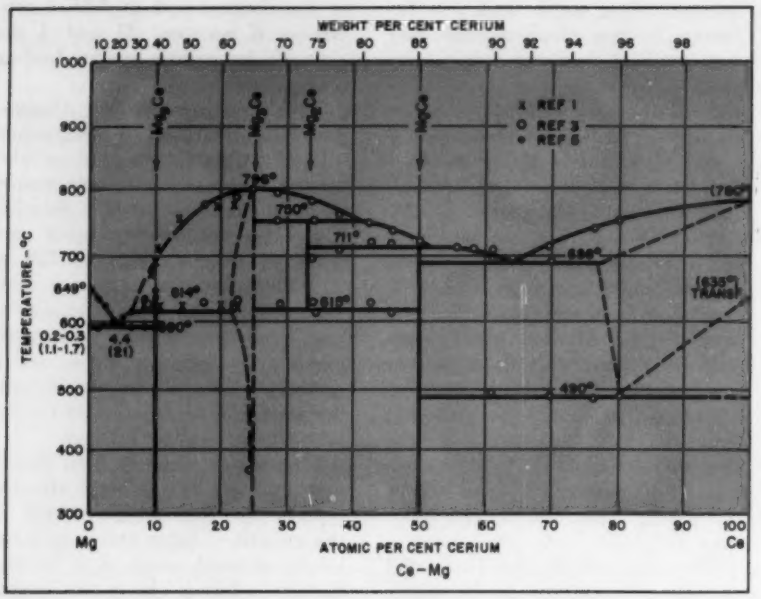


Fig. 20—System Mg-Ce equilibrium diagram. There probably is some solid solubility of cerium in magnesium although diagram does not show it

One patented method[11] of preventing germination is an interrupted solution heat treatment in which the castings are cooled below 500° F one or more times during heat treatment. This treatment apparently relaxes the internal stresses which are necessary for germination to occur. It is the practice with magnesium alloys containing very low melting constituents to raise the temperature of castings very slowly to the solution temperature or to take the lowest melting constituents into solution at one temperature and then complete the treatment at a higher temperature.

Unlike aluminum alloys, the rate of precipitation of dissolved alloying elements is relatively slow, and a fan quench generally is used after solution heat treatment.

Aging temperatures vary between 350 and 500° F, and aging times usually are considerably longer than those used for aluminum alloys. They may vary between 3 and 72 hr for different magnesium alloys depending to a considerable extent on the temperature employed.

Grain Refinement—Grain refinement of hexagonal metals such as magnesium is much more important from the mechanical property standpoint than is the case with cubic metals such as aluminum. This is associated with the fewer number of favorable slip planes in the hexagonal lattice compared with the cubic lattice and the beneficial effect of having increased numbers of randomly oriented grains. If a magnesium single crystal is stressed, slip will take place along the basal plane of the hexagonal lattice. As the number of grains in a casting is increased, slip will be forced to occur along other planes in poorly oriented grains, and the strength of the part will be improved accordingly.

Fortunately, there are means of achieving very fine grain sizes in magnesium alloys. In the alloys containing aluminum, superheating or treatment with a carbon-containing compound commonly is used. Superheating involves heating a melt to 1650-1700° F for a period up to 15 minutes and then cooling to the pouring temperature. Carbon may unite with aluminum to form nuclei while in the case of superheating the nuclei may be magnesium oxide or even an iron phase. Most of the alloys containing no aluminum are grain refined with zirconium, usually between ½ and 1 per cent.

For elevated temperature service, alloys based on additions of rare earth metals or thorium have assumed importance. Equilibrium phase diagrams based on these metals are not too well established.

Mg-Rare Earth Alloys—Fig. 20 shows a diagram for the Mg-Ce system.[12] This diagram does not show any solid solubility of cerium in magnesium although there probably is some solubility similar to that of lanthanum in magnesium which is shown in Fig. 21.[12] In any case, the solubility of the rare earth metals as a group is much lower than aluminum or zinc and, accordingly, there would be more tendency for eutectic formation even with additons of only 3 or 4 per cent rare earths. Also, since the eutectic temperature is considerably higher than is the case with Mg-Al alloys, the solidification range of Mg-rare earth metals

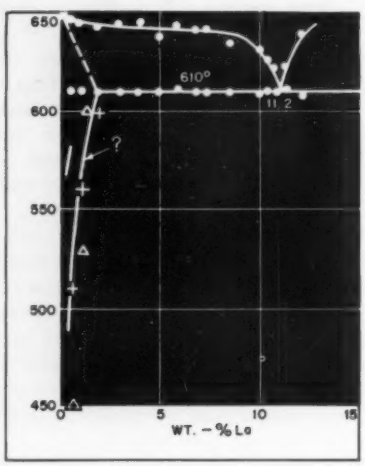


Fig. 21—Mg-La, magnesium end of the equilibrium diagram

would be correspondingly smaller.

This is shown in Fig. 22 depicting solidification curves for alloys EK41A and EZ33A. Alloy EK41A contains 4 per cent rare earths and EZ33A contains 3 per cent rare earths and 3 per cent Zn. The binary alloy has the expected narrow solidification range and forms a little more eutectic than the Mg-Al or Mg-Al-Zn alloys. Accordingly, it has somewhat better feeding characteristics and resistance to hot cracking. The presence of zinc in EZ33A increases the solidification range but it is still considerably less than that of the alloys contain-

ing aluminum and zinc. The fluidity of these alloys as well as thorium alloys, however, is not too good probably because of the pronounced oxide forming tendencies of the rare earths and thorium.

The rare earth alloys have outstanding elevated temperature properties from about 300 to 450° F while the thorium alloys are superior from about 450° to 650° F.

Mg-Th Alloys—Fig. 23 shows a tentative partial diagram for the Mg-Th system.[12] These alloys also should have a reasonably narrow solidification range but should not form as much eutectic as the Mg-rare earth alloys because of the higher solid solubility of thorium at the eutectic temperature, provided this diagram is correct. The casting characteristics of the Mg-Th alloys are similar to those of the Mg-rare earth alloys. Zinc appears to have a somewhat adverse effect on the resistance to hot cracking of alloys containing thorium.

Since the rare earth and thorium alloys are used at elevated temperatures, stabilizing aging treatments generally are used either with or without a prior solution heat treatment. Solution heat treating temperatures, if used, are much higher than for Mg-Al or Mg-Al-Zn alloys because of the higher solidus temperatures.

Summary—Although this presentation has been somewhat theoretical because of the very nature of the subject, most of the observations relating to casting characteristics or heat treatment are in agreement with production experience.

It has been shown that equilibrium diagrams for various aluminum and magnesium binary systems are useful tools in predicting the manner in which an alloy solidifies and the related casting characteristics. Even more precise information regarding solidification and casting characteristics are provided by cooling curves for specific alloys, particularly for ternary or more complex alloys.

One important factor must be considered in selecting an aluminum alloy for a specific application. The most desirable combinations of mechanical properties generally can be obtained in sound castings with heat treated, solid solution type alloys containing about the maximum quantities of alloying elements that can be taken into solid solution. Alloys from the Al-Cu, Al-Mg and Al-Zn-Mg systems are of this type. However, aluminum alloys containing about 5 to 9.5 per cent Si plus other elements have much better casting characteristics as indicated by appraisal of equilibrium diagrams and cooling curve data, and may provide better properties in castings because of increased soundness.

There is considerably less variation in the generally poor casting characteristics of magnesium base alloys. For applications other than those at elevated temperatures, the most satisfactory combinations of mechanical properties and casting characteristics usually are provided by the alloys containing relatively high aluminum and low zinc contents.

REFERENCES

1. W. E. Sicha and R. C. Boehm, "A Fluidity Test for Aluminum Casting Alloys," *Transactions*, AFS, Vol. 56, p. 502, 1948.
2. S. Fioreen and D. V. Ragone, "The Fluidity of Some Aluminum Alloys," *Transactions*, AFS, Vol. 65, p. 391, 1957.
3. E. E. Stonebrook and W. E. Sicha, "Correlation of Cooling Curve Data with Casting Characteristics of Aluminum Alloys," *Transactions*, AFS, Vol. 57, p. 480, 1949.
4. W. A. Baker, "Shrinkage and Gas Effects in the Casting of Non-Ferrous Metals and Alloys," Report, British Non-Ferrous Metals Research Association, 1944.
5. H. Carpenter and J. M. Robertson, *Metals*, Oxford University Press, London, New York, Toronto, 1939.
6. D. C. G. Lees, "The Hot-Tearing Tendencies of Aluminum Casting Alloys," *Journal of the Institute of Metals*, Vol. 72, p. 343, 1946.
7. H. J. Rowe and W. E. Sicha, "Cast Aluminum Alloys Heat Treatment," *Transactions*, AFS, Vol. 54, p. 424, 1946.
8. L. F. Mondolfo, *Metallography of Aluminum Alloys*, John Wiley & Sons Inc., New York, 1943.
9. *Metals Handbook*, ASM, 1948.
10. E. M. Gingerich, "Heat Treatment of Magnesium Alloy Castings," *Transactions*, AFS, Vol. 60, p. 641, 1952.
11. R. T. Wood and M. E. Gantz, U. S. Patent 2,389,583, Nov. 20, 1945.
12. Max Hansen, *Constitution of Binary Alloys*, McGraw-Hill Book Co., New York, 1958.

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Fig. 22—Curves show relative proportions of alloys solidifying at different temperatures

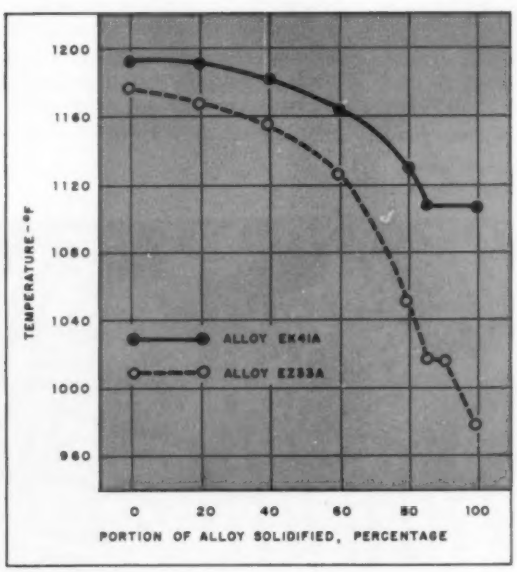
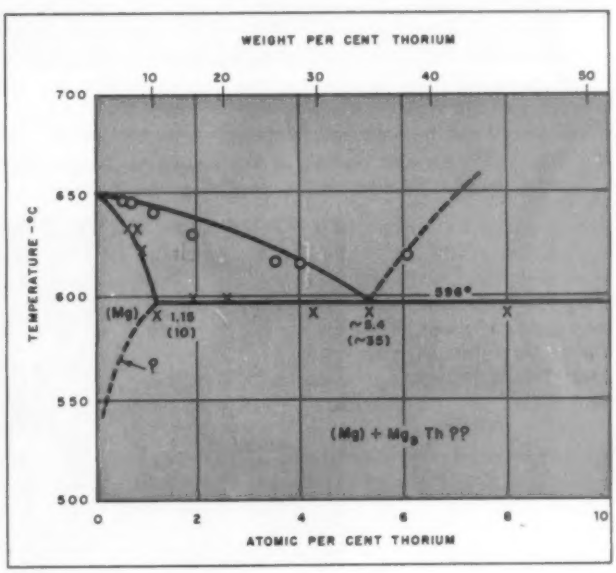


Fig. 23—Tentative partial diagram for the magnesium end of the Mg-Th system



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Chicago

Copper-Base

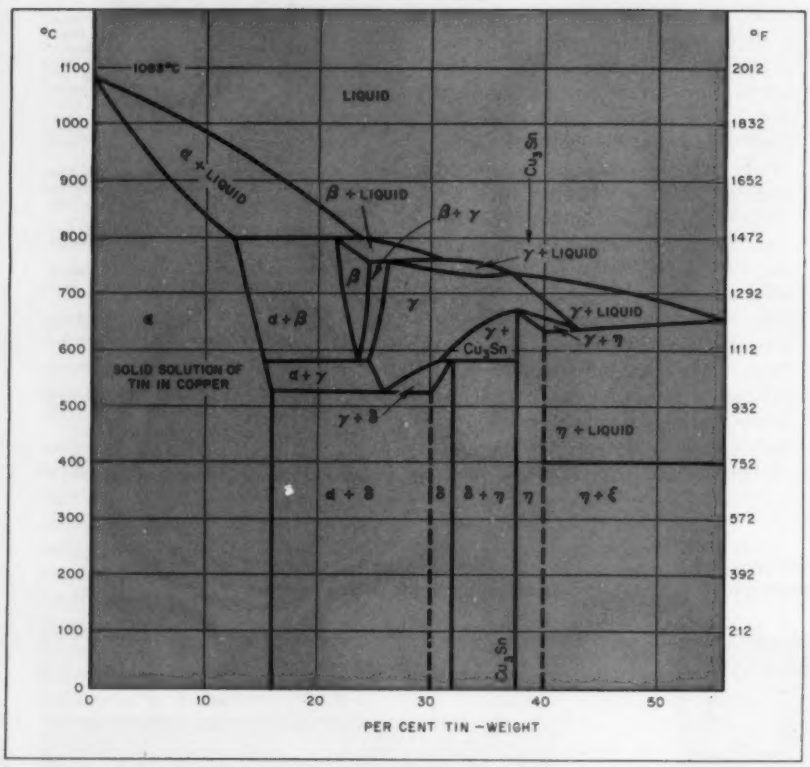


Fig. 1—Copper-rich portion of the copper-tin constitution diagram provides helpful information in predicting the behavior of these alloys

● EQUILIBRIUM PHASE diagrams can be very useful tools in the hands of a brass foundryman when he understands the basic fundamentals. A fracture test might explain what happened to a particular melt, but a phase diagram can be used to predict what will happen under a particular set of conditions, as explained in Professor Wallace's article (Page 84).

Although the volumetric shrinkages of the four copper-base alloys shown in Table I are similar, the freezing ranges vary widely. This accounts for differences in solidification characteristics. A narrow freezing range has a tendency to promote centerline shrinkage or piping, whereas a wide freezing range will tend to cause interdendritic or dispersed porosity unless proper risering and directional solidification are provided.

Copper-Tin Diagram—The Cu-Sn constitution diagram in simplified form as shown in Fig. 1 provides much useful information in predicting the behavior of these alloys. Very slowly cooled alloys with up

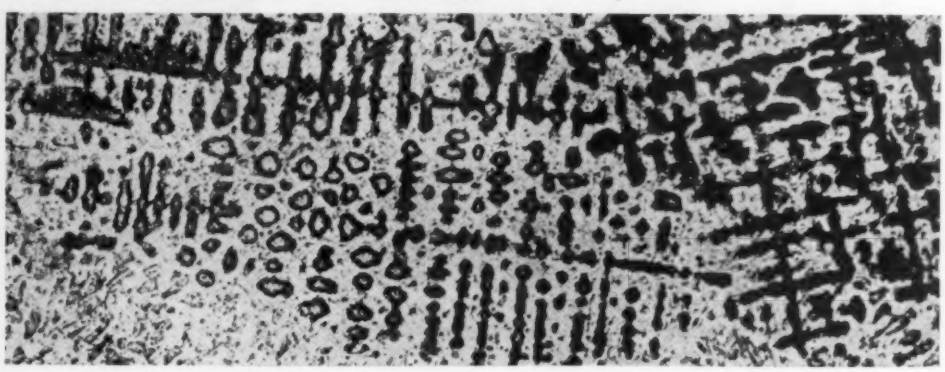


Fig. 2—Tin-bronze microstructure shows alpha dendrites in an alpha-delta eutectoid

Alloys

to 16 per cent Sn should consist of a single phase alpha solid solution. This alpha phase is soft and ductile and increases in strength as the tin content increases up to 16 per cent. Alloys containing more than 16 per cent Sn also contain a delta constituent, which consists of the intermetallic compound, Cu_4Sn.

TABLE I—Volumetric Shrinkage vs. Freezing Range for Copper-base Alloys

Alloy	Shrinkage %Vol at room temp	Freezing range °F
90% Cu—10% Al aluminum bronze	4.6	20
High tensile manganese bronze	5.2	55
92% Cu—8% Sn high-strength yellow brass	5.8	360
85% Cu, 5% Zn, 5% Sn, 5% Pb leaded red brass	6.1	1100

The above conditions are those of stable equilibrium, which is not obtained in the normal cooling rate of castings. Due to the sluggishness with which the transformations occur, all alloys containing over 7 per cent Sn in the as-cast condition show quantities of alpha-delta eutectoid, and only alloys with less than 7 per cent Sn solidify entirely as an alpha solid solution.

Only the alpha constituent and the alpha-delta eutectoid are stable at room temperatures in alloys containing up to 30 per cent Sn. The beta constituent is stable at red heat and will transform to the eutectoid unless quenched rapidly from above 1000° F. While the alpha constituent is soft and ductile, the delta constituent forms intermetallic compounds which are hard and brittle. Because of the lack of ductility, high tin bronzes are seldom used commercially except in the cast condition. As the quantity of delta is increased, the alloy becomes harder and less ductile. The shape and distribution of the delta exerts considerable influence on the properties.

When other constituents such as zinc and phosphorus are added to Cu-Sn alloys, the delta formation is affected. The rate of solidification and cooling influences both the grain size and the amount of delta formed. The rate of cooling and solidification depends on the superheat, casting size, molding material, and other factors. A low pouring temperature will produce more rapid solidification and nonequilibrium behavior than a higher pouring temperature. Consequently, a lower pouring temperature will form more alpha-delta eutectoid for a given composition, and harder castings are produced.

Segregation in Castings—Because of the slow rate at which diffusion occurs and the large amount of diffusion required for alloys in the Cu-Sn diagram, a certain amount of coring takes place. This can be un-

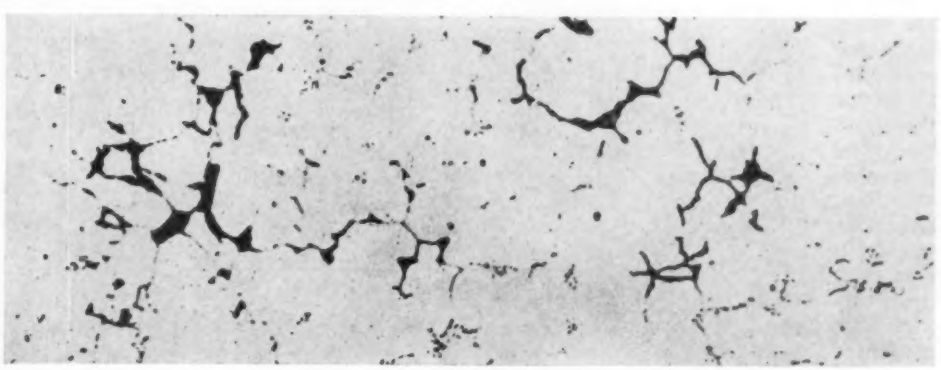


Fig. 3 — Bronze sand casting shows fissure porosity due to inadequacy of risering

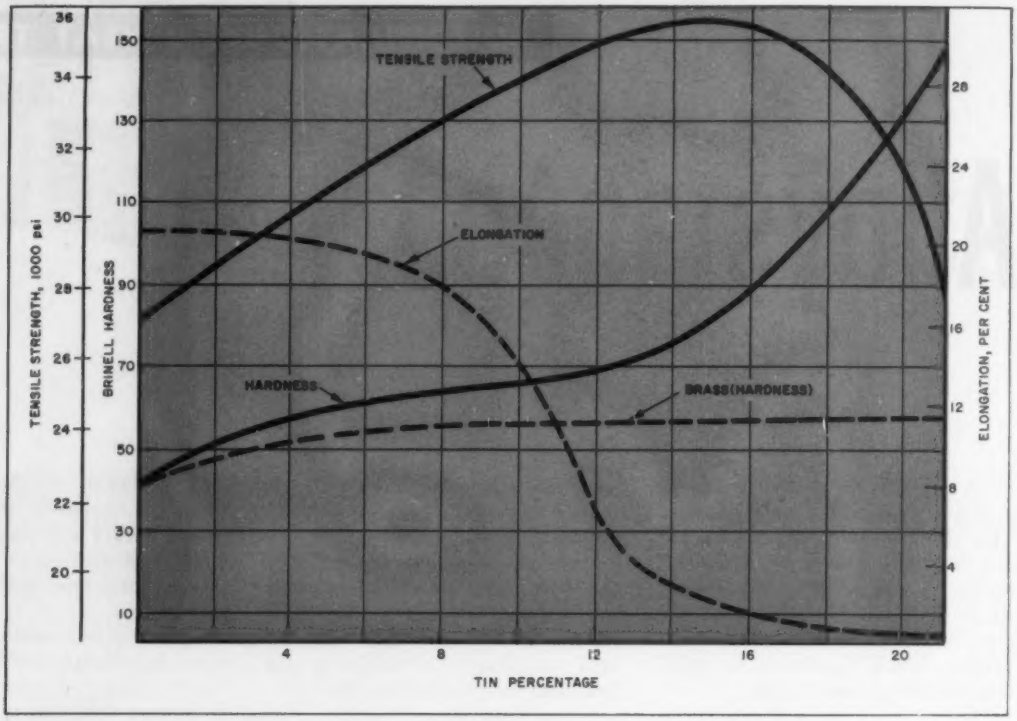


Fig. 4—Series of curves representing the changes in the mechanical properties of copper-tin alloys when the tin content is increased from 0 to 20 per cent

derstood best by analyzing the freezing of a typical alloy in the alpha range. An alloy containing 10 per cent Sn is entirely liquid above the liquidus temperature. When the temperature decreases, crystals of solid solution metal are deposited. The first crystals to form theoretically will have a composition of approximately 2.5 per cent Sn. This value is obtained by drawing a horizontal line from the intersection of the vertical line at 10 per cent Sn with the liquidus to the right boundary of the alpha solid solution field.

The relatively slow diffusion rates of the copper and tin result in nonequilibrium solidification under most conditions, however, and the composition of the first alpha crystals to solidify usually contains considerably less than 2.5 per cent. As the temperature decreases and solidification continues, the composition of the solid solution, alpha, generally contains considerably less tin than is indicated by the right-hand boundary of the alpha field. The remaining liquid consequently is enriched in tin. When this final liquid does solidify, it has been so increased in tin content, that considerable beta is present with the alpha.

The final solid structure then consists of some areas of high-copper, low-tin content at the first locations to solidify which are surrounded by layers of alpha with increasing tin content. These alpha areas are surrounded in turn by a network of alpha and beta formed as the final liquid solidifies.

As the temperature is lowered further below 1000° F, the beta will transform into the alpha-delta eutectoid in the usual manner. The microstructure shown in Fig. 2 illustrates dendrites rich in copper and a Cu-Sn matrix or, expressed in another way, alpha dendrites in an alpha-delta eutectoid. According to the phase diagram, however, this alloy should have been all alpha.

The same alloy with inadequate

Fig. 5—Dendritic structure of as-cast alloy, 80 Cu-10 Sn-5 Zn-5 Ni. Magnification, 100 X

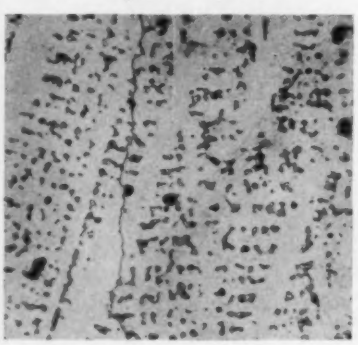
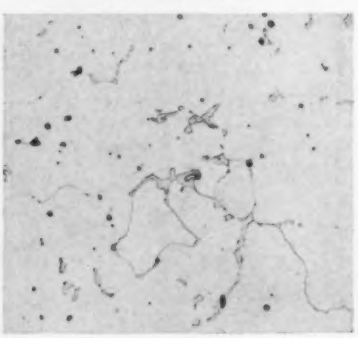


Fig. 6—Same alloy after being heat treated for 5 hours and water quenched. 100 X



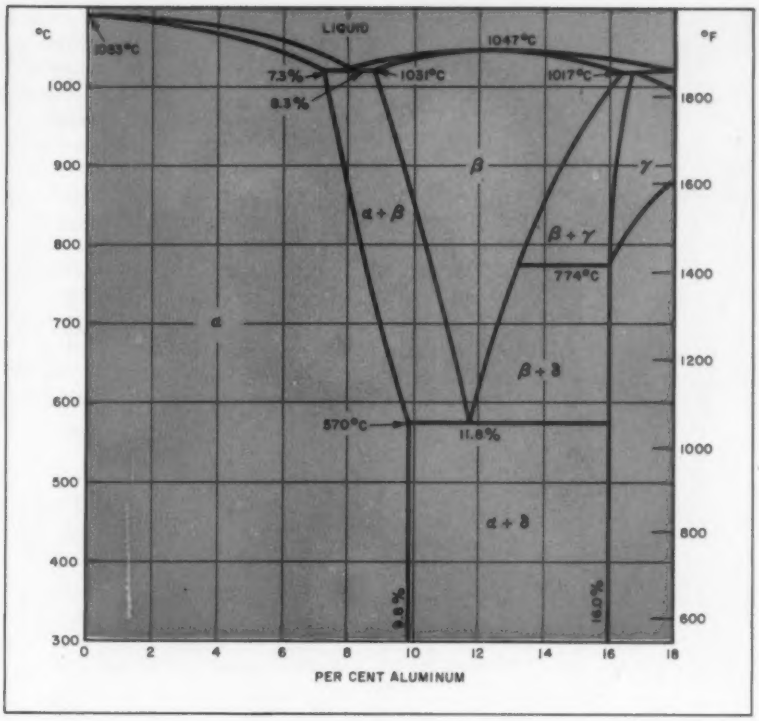


Fig. 7—High-copper section of copper-aluminum constitution diagram (Stockdale). Commercial aluminum bronzes can be considered to include two groups

risering, Fig. 3, exhibits a fissure type porosity (shrinkage porosity). This type is detrimental to pressure tightness and mechanical properties. In some cases it can be tolerated if it is dispersed widely and not interconnected.

The preponderance of commercial bronzes are of this type composition, exhibiting long freezing ranges or wide liquidus-solidus spreads. As a result, they show coring, segregation, and a greater tendency toward shrinkage porosity. Consequently, castings made with these alloys are more difficult to riser and feed properly.

Fig. 4 is a series of curves representing the changes in the mechanical properties of Cu-Sn alloys as the tin content is increased from 0 to 20 per cent. As the tin content increases from 7 to 15 per cent, the tensile strength and Brinell hardness increase and the elongation decreases. As the tin content is raised to 20 per cent, the tensile strength begins to decrease, and the ductility becomes very poor because of embrittlement, but the Brinell hardness continues to increase. These changes in physical properties are due to the amount and shape of the delta constituent in the alloy.

Heat-Treatment — Some of the copper-base alloys respond to heat treatment. The Cu-Al bronzes frequently are heat treated to improve the mechanical properties, although some improvement in properties also is possible with other compositions such as Cu-Ni and Cu-Sn-Ni. The effect of heat treatment on the Cu-Sn-Ni alloy microstructure is shown in Fig. 5 and 6.

Fig. 5 exhibits an as-cast dendritic structure and has a tensile strength of 55,000 psi, yield strength of 29,000 psi, elongation of 20 per cent, and a Brinell of 105. When the same alloy is heat treated for 5 hr at 1400° F and water quenched, the structure, as shown in Fig. 6, is an alpha matrix with beta at the grain boundaries, and the physical properties show a tensile strength of 65,000 psi, yield strength of 26,000 psi, elongation of 63 per cent, and a Brinell of 91.

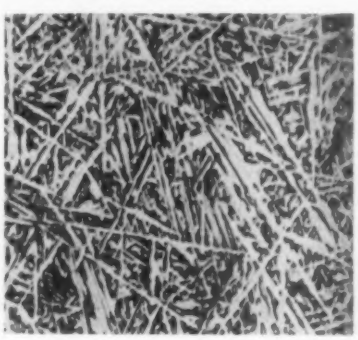
Copper-Aluminum Diagram — The high-copper section of the Cu-Al constitutional diagram is reproduced in Fig. 7. The commercial aluminum bronzes can be considered as falling into two groups. Those in the first group contain from 4 to 7 per cent Al and exhibit a homogeneous single-phase solid-solution structure.

Alloys in the second group contain from 8 to 12 per cent Al, often with additions of iron, manganese, nickel, and other elements and have more than one phase. The alpha

TABLE II—How To Calculate Fictitious Zinc Content in an Alloy

Zinc Equivalent Factors			Actual Analysis	Zinc Equivalent Analysis
Silicon	10.0	Copper	62.35%	
Aluminum	6.0	Aluminum	5.50 × 6.0 =	33.00%
Tin	2.0	Iron	2.75 × 0.9 =	2.48
Magnesium	2.0	Manganese	4.00 × 0.5 =	2.00
Nickel	1.2	Zinc	25.40 × 0.1 =	25.40
			100.00%	62.88%
Lead	1.0			
Iron	0.9	Cu + Equivalent Zn = 62.35 + 62.88 = 125.23		
Manganese	0.5	% Fictitious Zn = $\frac{62.88}{125.23}$ = 50.2%		

Fig. 8—Microstructure of heat treated aluminum bronze alloy, 89% Cu, 1% Fe, 10% Al



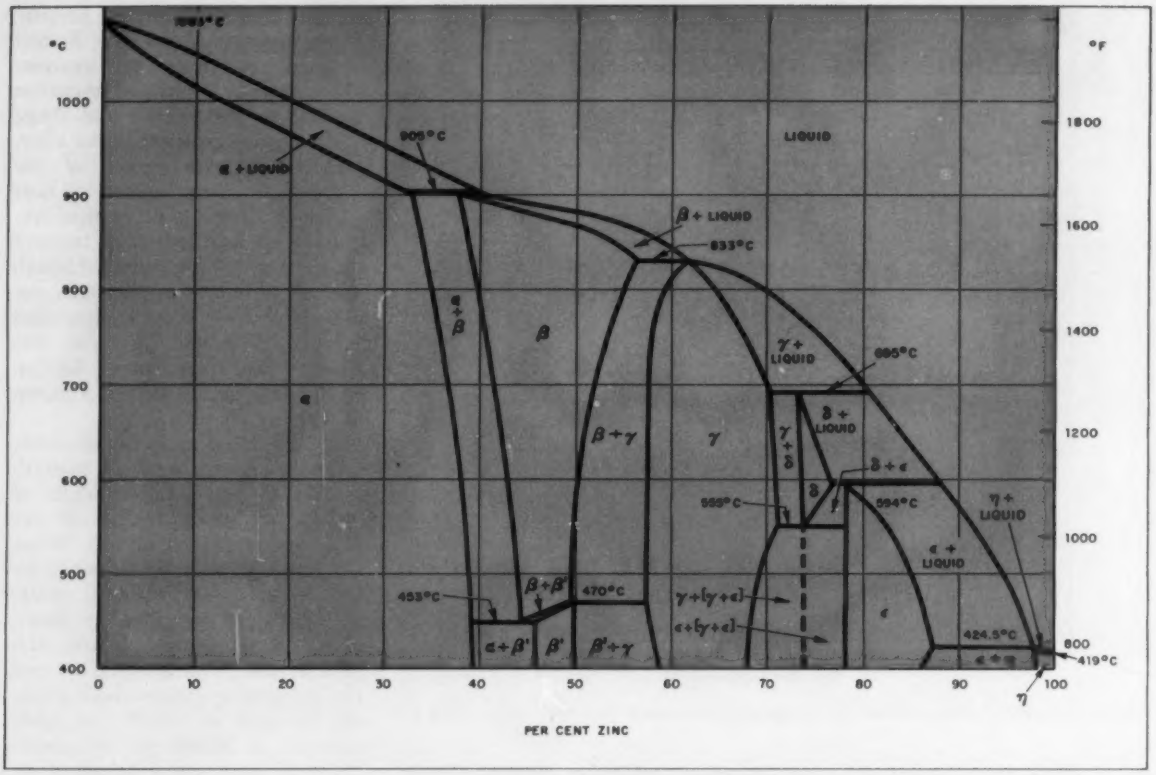


Fig. 9—Copper-zinc equilibrium diagram. Due to the short freezing range, these alloys are more prone to piping than to shrinkage porosity

solid solubility limit extends up to 9.8 per cent Al. In practice, because of nonequilibrium effects, the limit of the alpha range of alloys is regarded as occurring at about 8 per cent Al.

Due to the short freezing range (the liquidus and solidus are separated by only a few degrees), considerable centerline and gross shrinkage occurs in the aluminum bronzes. Risers of considerable size, similar to those for steel, are employed to avoid these defects. Due to this short freezing range, there is less microshrinkage in these alloys than in the Cu-Sn alloys.

The eutectoid reaction (beta transforming to alpha plus delta) occurs relatively slowly. At the rates of cooling normally encountered in castings, very little beta transforms to the eutectoid during cooling after solidification. An alloy in the range of 9 to 11 per cent Al—which theoretically should be all alpha and delta—solidifies in the following manner: The liquid solidifies as all beta, and, in cooling, some of the beta transforms to alpha and the alpha-delta eutectoid. Because of the rapid cooling and the sluggishness of the eutectoid reaction, however, much of the beta remains untransformed. In contrast with the alpha phase, the delta constituent is very hard and brittle.

This diagram indicates that the phases and structure of the alloys between 9 and 11 per cent Al can be modified by heat treatment. Fig. 8 shows a microstructure of a heat treated 89 per cent Cu—1 per cent Fe—10 per cent Al alloy. After casting, it was heated for 2 hr at 1650° F and water quenched, treated for 2 hr at 1200° F and again water quenched. At 1650° F it was in the alpha plus beta field, and, when quenched, these phases remained, and the eutectoid reaction did not occur.

The microstructure, Fig. 8, shows the beta or beta prime phase in an alpha matrix. As-cast properties were tensile strength of 76,600 psi, 28,400 psi yield strength, 17 per cent elongation, and 150 Brinell hardness. After the above heat treatment, the properties were improved appreciably to 92,500 psi tensile strength, 37,000 psi yield strength, 12.5 per cent elongation, and 177 Brinell hardness.

Copper-Zinc Diagram — In its main features, the Cu-Zn equilibrium diagram, Fig. 9, bears a resemblance to the copper-tin diagram. Due to the short freezing range, these alloys are prone to piping, more than shrinkage porosity. The first additions of zinc are retained in solid solution until approximately 32 per cent Zn is reached. Beyond this level a second solid solution, beta phase, appears, and this solution undergoes some transformation in the solid state before reaching room temperatures.

Since the alpha brasses (including most of the commercial brass casting alloys) pass through no solid transformations on cooling, they are simple, solid solutions of

zinc in the copper lattice and cannot be hardened by heat treatment. The alpha brasses are progressively stronger, harder, and cheaper as the zinc content increases. The beta brasses contain even larger amounts of zinc and tend to be harder and less ductile than alpha brasses.

To determine what properties and structure to expect, since other elements are present in the alloy, zinc equivalents may be used to calculate what the alloy might be on a simple Cu-Zn basis. Table II lists the zinc equivalents and shows an example of how the fictitious or equivalent zinc is calculated. In this example, the alloy will have a structure equivalent to a 50.2 per cent Zn alloy and, therefore, the alloy will be all beta as shown in Fig. 10. This alloy has the analysis shown in Table II.

To show the various phases, the copper content was increased in steps from 62.35 to 67.87 per cent as indicated in Table III. Fig. 10 through 14 show the resultant microstructures. The alpha phase does not begin to appear until the equivalent zinc is 47.9 per cent. When this value drops to 45.8 per cent, considerable alpha is present. The microstructures in Fig. 10 and 11 are entirely beta. All the samples were etched with $FeCl_3$ and are at 100 diameters magnification.

BIBLIOGRAPHY

1. J. Laing and R. T. Rolfe, *Nonferrous Foundry Practice*, Chapman & Hall Ltd., 1943.
2. R. W. Heine and P. C. Rosenthal, *Principles of Metal Casting*, McGraw-Hill Book Co., 1955.
3. *ASM Metals Handbook*, American Society for Metals, 1948.
4. *Copper-base Alloy Foundry Practices*, American Foundrymen's Society, 1952.
5. H. C. Dews, *Metallurgy of Bronze*, Sir Isaac Pitman & Sons Ltd., 1930.
6. *Aluminum Bronze*, Copper Development Association, London, England.

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Fig. 10

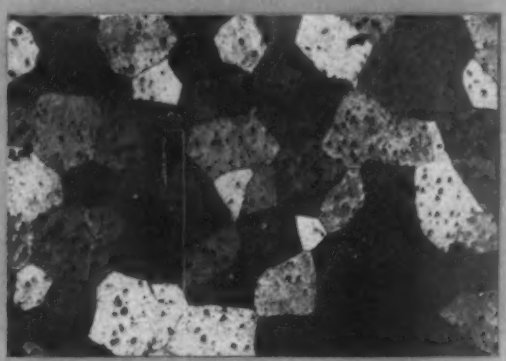


Fig. 11

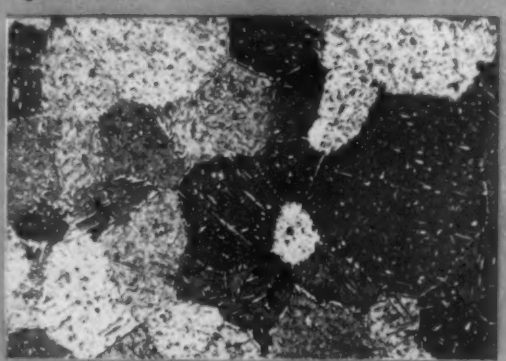


Fig. 12

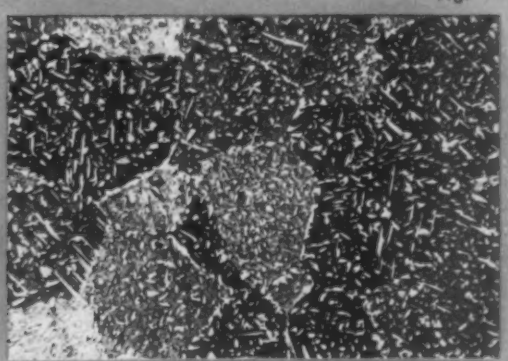


Fig. 13

TABLE III—Composition of Various Manganese Bronze Alloys

Microstructure in Figure No.	Cu Equiv	Zn Equiv	T.S. psi	Y.S. psi	Elong %
10	62.35	50.2	118,000	74,000	16
11	63.73	49.2	117,000	72,000	17
12	65.21	47.9	112,000	64,000	18
13	66.48	46.9	108,000	59,000	20
14	67.87	45.8	98,000	48,000	23

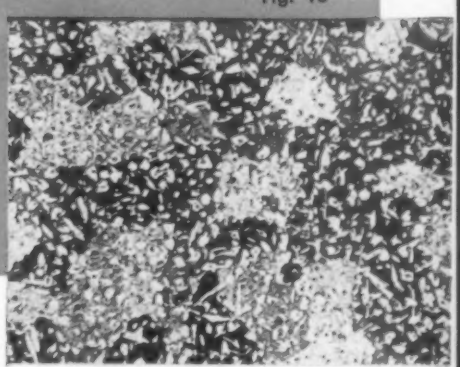
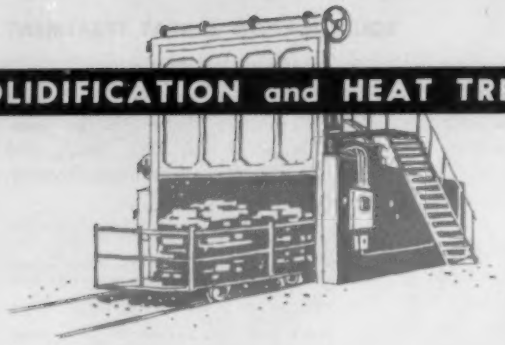


Fig. 14

Figs. 10-14—Microstructures of manganese bronze alloys. X100. Copper content was increased in steps from 62.35 to 67.87 per cent. Alpha phase does not begin to appear until zinc equivalent is 47.9 per cent

SOLIDIFICATION and HEAT TREATMENT



Gray Iron

● UNLIKE steel or most other alloys, cast iron of a given analysis may follow more than one process during solidification, yielding a product which may vary considerably in both structure and properties. These variations depend on the rate of freezing and treatment of the metal during melting.

Cast irons usually are defined as a family of alloys of iron, carbon, and silicon having a steel-like matrix and containing an excess of carbon as either iron carbide or graphite. An ordinary gray iron may contain about 93 per cent iron with possibly 3.5 per cent carbon (mostly present as graphite), and 2 per cent silicon. There are also minor amounts of manganese, sulfur, phosphorus, and other residual or alloying elements. The phosphorus and sulfur both form compounds—the phosphorus with carbon and iron and the sulfur with manganese. The result is a material which is heterogeneous in nature, having widely different phases easily identified under the microscope. Distribution of these phases can vary considerably even in irons of the same analysis.

Useful Properties—The cast irons have a number of most useful properties. They have excellent fluidity and a relatively low freezing temperature; consequently they do not punish the mold severely and make it a rather simple matter to produce castings having a smooth surface and pattern fidelity.

They have excellent shrinkage properties, and in some compositions there is no shrinkage during solidification. This property makes possible the production of sound castings more readily than is the case with most other metals. Depending on composition, cast irons have excellent machinability, high resistance to wear, and excellent resistance to heat shock—properties which are conferred largely by their graphite content. On the other hand, the gray irons have rather low tensile strength and are relatively brittle—also the result of the presence of a large amount of graphite in their structure.

Both the founding and mechanical properties of cast irons are fixed largely by the position of a given composition on the iron-carbon-silicon equilibrium diagram. Fig. 1 shows both the conventional iron-carbon equilibrium diagram (0 per cent Si) and the diagram for an alloy containing 2 per cent Si (a fairly normal level for cast iron). Comparing these diagrams, we note considerable similarity. Note that the eutectic at 4.3 per cent carbon in the silicon-free material occurs at a lower carbon level of about 3.65 per cent when 2 per cent Si is present. It will also be noted that the eutectoid composition of 0.90 per cent C in silicon-free material is lowered to about 0.65 per cent in the presence of 2 per cent Si.

In other words, the addition of silicon to an iron-carbon alloy has lowered the carbon level of both the eutectic and eutectoid compositions, and it becomes apparent that we can use the iron-carbon diagram to represent fairly accurately the freezing phenomena in an iron-carbon-silicon alloy if we add to the carbon content one-third of the silicon present. This, in effect, is the carbon equivalent (CE) which is so widely used in cast iron metallurgy as a means of comparing irons of unlike composition. Carbon equivalent is, of course: CE = % C + 1/3 per cent Si or, in a slightly more accurate version, CE = % C + 0.3 (% Si + % P).

What It Indicates—By substituting carbon equivalent for total carbon content we are able to use the iron carbon equilibrium diagram to predict the behavior of a given cast iron during solidification as well as its founding and mechanical properties. From our study of equilibrium diagrams we will at once recognize that a composition having a CE of 4.3 is eutectic in nature, having a single freezing temperature at the bottom of the valley formed by the liquidus line. This means that such an iron freezes at a lower temperature than other compositions and that there is no mushy stage during solidification. Compared with irons of higher or lower CE it will, when poured at a given temperature, have excellent fluidity.

The high CE means the structure will contain a large amount of graphite, indicating low strength, good machinability, and a high degree of the other properties conferred on cast iron by its graphite content. Since the graphite is low in density (about one-third that of the iron) and is precipitated during solidification, such an iron will exhibit little tendency toward formation of shrinkage defects.

This combination of good founding properties and machinability explains the popularity of eutectic

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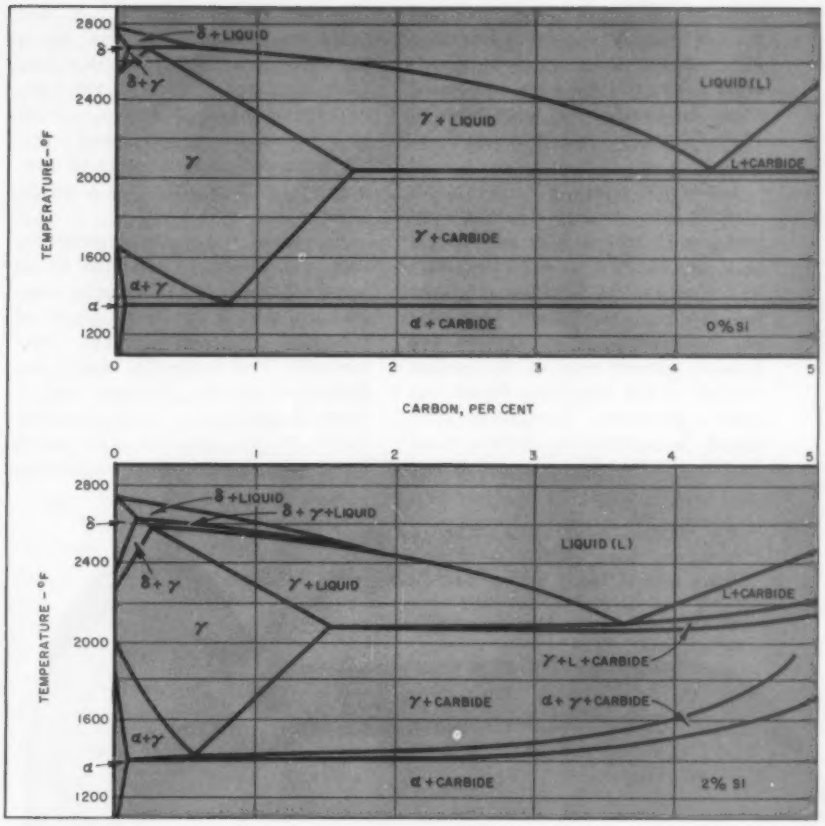


Fig. 1—Two sections through the ternary diagram of the iron-carbon-silicon system according to Greiner, Marsh, and Stoughton

Fig. 2 — Etched microstructure of white cast iron. Shows pearlite dark and cementite white

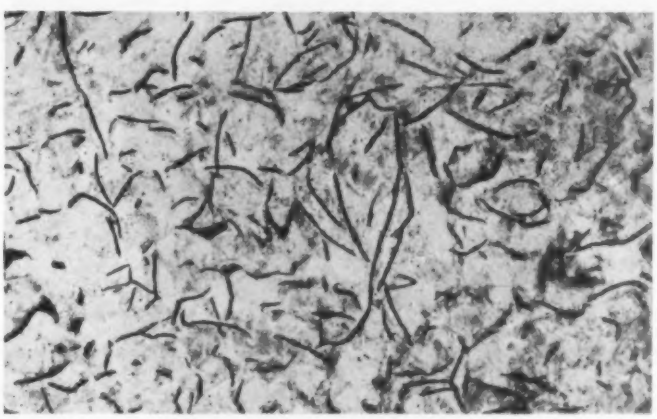


Fig. 3—Microstructure of gray cast iron containing pearlite and graphite. It has undergone stable solidification

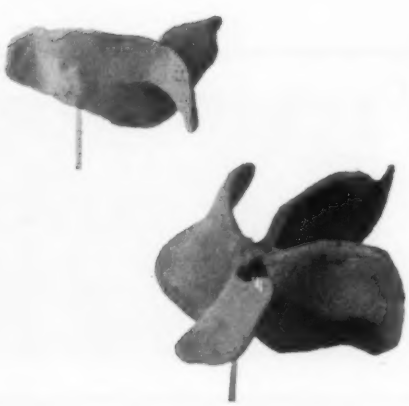


Fig. 4—Models of graphite whorl type flakes according to MacKenzie. X 150. (*The Structure of Cast Iron*, Boyles)

irons of about 3.5 per cent C and 2.5 per cent Si for the production of light-sectioned castings in which these properties are more important than the mechanical properties of high strength and resistance to wear.

Lower CE Iron—A harder hypoeutectic iron of lower CE, the composition of which falls to the left of the eutectic, will, of course, start to freeze at the liquidus temperature for its composition. Dendrites of austenite low in carbon are formed, leaving most of the carbon behind in the remaining liquid. As more dendrites precipitate, the liquid is enriched in carbon until its CE reaches the value of 4.3 or the eutectic composition. At this point the balance of the liquid freezes by eutectic solidification similarly to a eutectic iron. Obviously, iron of this type begins freezing at a higher temperature, and freezing progresses over a range of temperature rather than at a single point.

Poured at the same temperature, this iron would be expected to be less fluid than iron of eutectic composition, due to the lesser degree of superheat before freezing commences. The lower CE means the formation of less graphite, and a lower degree of the properties conferred by the graphite also means more shrinkage during solidification as well as less interruption of the continuity of the matrix, resulting in higher strength.

For these reasons, the foundryman wishing to make a high-strength gray iron or one having high resistance to wear, will select a composition to the left of the eutectic. In doing so he will expect to encounter somewhat greater difficulty in gating and risering to produce a sound casting, depending largely on how much the composition he selects is below the 4.3 CE eutectic composition.

The freezing of a hypereutectic iron above 4.3 CE is similar except that graphite flakes start forming at the liquidus temperature for the composition involved. This gradually decreases the carbon content of the remaining liquid as the temperature falls until the 4.3 CE eutectic is reached, at which point the balance of the liquid solidifies. Irons of this type seldom are used for most types of castings.

This mode of solidification is typical of pig iron, the very high-carbon iron used in ingot molds, and some types of very light castings. As graphite begins to precipitate in the liquid, very large flakes can form, and due to this and the high graphite content, such irons have little strength. They do, however, have valuable properties of resistance to heat shock and are used widely in applications such as heavy-duty brake drums and ingot molds.

Stable and Metastable Solidification—The structure of an iron casting and, of course, its properties are affected not only by composition but also by its freezing rate, the cooling rate in the mold after it is solid, and any heat treatment it

Fig. 5—Section of chilled iron car wheel showing transition from chilled or white iron at tread to gray iron in web. *(Gray Iron Castings Handbook)*

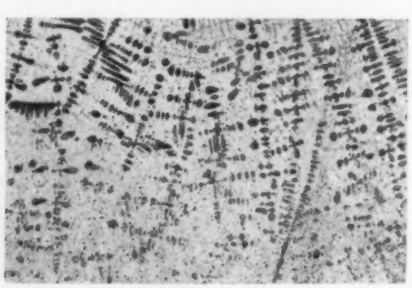


Fig. 6-9—Left to right, sample quenched from 2100°F, heat treated, X 20; sample quenched from 2040°F, heat treated, X 20; sample quenched from 2025°F, heat treated, X 20; and sample quenched from 1970°F, heat treated, X 20. *(The Structure of Cast Iron,* Boyles)

may receive. It is well known, of course, that a given iron, depending on the rate of freezing, may have a hard unmachinable structure with a white fracture or it can be a strong useful gray iron. If poured into a very heavy section which cools slowly, the same metal may yield a soft coarse grain material of low strength.

If cast iron solidifies rapidly, there may not be time for nucleation and growth of the graphite flakes; the result is a white iron having the carbon present as iron carbide—the white structure shown in Fig. 2. Since iron carbide has about 700 Brinell hardness, white irons usually are above 350 Brinell hardness and unmachinable.

When cast iron freezes rapidly enough to form iron carbide (white iron) rather than graphite, it is said to have undergone "metastable solidification." When it solidifies to form a gray fracture with most of the carbon as graphite, as shown in Fig. 3, we say it has undergone "stable solidification."

The iron-carbon equilibrium diagrams for the stable and metastable systems show minor differences, which in this case we can overlook. It is sufficient to recognize that solidification by the metastable system to form white iron is promoted by low carbon or silicon content (low CE) or by rapid freezing as the result of pouring into light sections. On the other hand, as the carbon equivalent increases or the rate of solidification decreases, the iron tends to solidify by the stable system as gray iron containing most of the carbon as graphite flakes. Models of graphite whorl type flakes according to MacKenzie are shown in Fig. 4.

Carbon Depletion—After solidification of the eutectic is completed at the solidus temperature, the solidified iron has the equivalent of 1.7 per cent carbon in solution, the balance existing as graphite. Further cooling results in gradual depletion of the carbon in solid solution to a level of 0.85 per cent CE at the transformation temperature, the extra carbon being deposited on the graphite. Transformation of the austenite in the matrix at about 1300° F results in the formation of a pearlitic matrix.

Due to its silicon content pearlite in cast iron is not particularly stable during eutectoid transformation and on slow cooling may decompose further to graphite and ferrite. In other words, eutectoid transformation can also be metastable, resulting in a high-strength, wear-resistant pearlitic gray cast iron, or under conditions of slow cooling the transformation may be "stable," resulting in a very soft structure of graphite in a matrix of ferrite. If cooling is slow enough, the stable ferrite-graphite structure always will be obtained.

The foundryman who encounters a chilled corner of hard white iron finds the metastable nature of cast iron during solidification a problem; the producer of chilled rolls or car wheels uses this phenomenon to produce useful properties. The effect of freezing rate on structure is illustrated by the chilled iron car wheel (Fig. 5). By casting against an iron chill in the mold, solidification is accelerated and a hard, wear-resistant white iron tread is obtained (metastable system). In areas more remote from the chill, solidification is not so rapid and the result is a softer gray iron of higher strength and toughness (stable system).

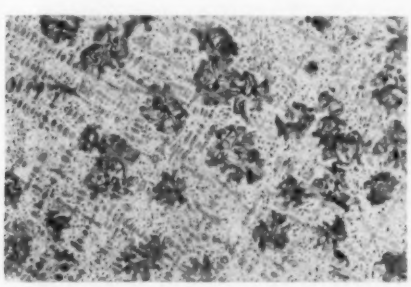
Section thickness of a casting as it affects the rate of solidification also affects the structure and properties of gray iron by limiting or allowing time for graphite growth during solidification. High freezing rates in light sections may yield a relatively fine graphite dispersion and fine fracture. The same iron poured into heavier sections solidifies more slowly so that graphite flakes have opportunity to grow and may become large. The result may be a soft open-grain iron.

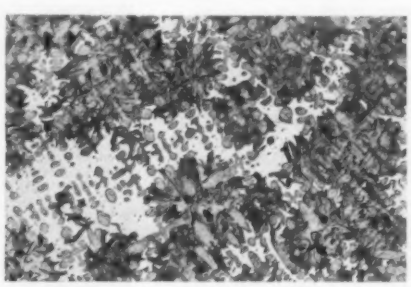
This effect of solidification rate on the structure and properties of cast iron is recognized in gray iron specifications by providing test bars of varying diameter to represent castings of heavy or light section.

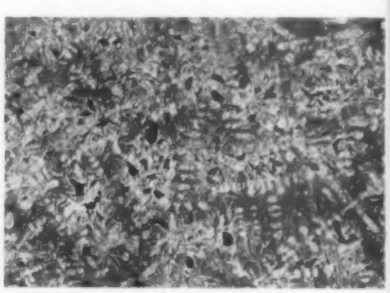
To the iron foundryman, the section sensitivity of gray iron means he must melt irons of varying composition to match the requirements for heavy or light castings. This complication does not exist with steel or most other alloys. The steel foundryman uses the same Grade B steel and obtains roughly similar properties in either heavy or light castings.

Dendritic and Eutectic Solidification—Boyles has demonstrated the mechanism by which cast iron solidifies. He made a series of melts of hypoeutectic iron-carbon-silicon alloy which were water quenched from a series of temperatures in these solidification ranges:

Fig. 6—*Quenched from* 2100° *F.* Shows the formation of dendrites of austenite during dendritic solidification. These dendrites are relatively low in carbon and the matrix gradually is approaching the eutectic 4.3 CE level.







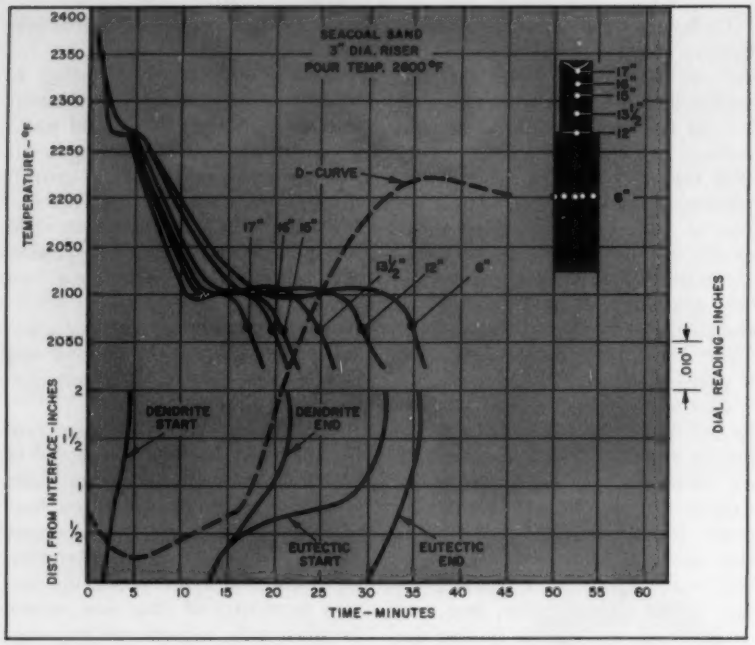


Fig. 10—Thermal and dilatometer data during solidification of 3-in. risered casting in seacoal sand. ***(Transactions,*** **AFS 1952, Dunphy and Pellini)**

Fig. 7—*Quenched from* 2040° *F.* Freezing of the eutectic is underway. Eutectic cells are superimposed on the austenite dendrites. Formation of graphite flakes is beginning in each eutectic cell.

Fig. 8—*Quenched from* 2025° *F.* Eutectic cells are growing as freezing progresses. Graphite flakes are growing outward into the liquid metal.

Fig. 9—*Quenched from* 1970° *F.* Freezing is complete. Eutectic cell structure is superimposed upon the austenite dendrites formed earlier during dendritic solidification.

Mode of Solidification—Mr. Yearley, in his discussion on steel (Page 116), stresses the fact that steel in freezing is a skin-forming alloy with solidification starting at the mold surface as a thin envelope of solid steel. Crystals grow in from this envelope and a thick, rigid shell of steel forming rapidly contains a center of solidifying liquid. Due to the low carbon level of steel, little eutectic is formed and the freezing takes place almost entirely by dendritic solidification.

In hypoeutectic gray irons, the beginning of freezing also takes place by formation of dendrites which grow into the liquid metal. Because of the high carbon level of most cast irons, however, the quantity of these dendrites is limited. In soft. eutectic irons, of course, they do not form at all. Unlike steel, therefore, cast iron does not freeze by progressive growth of an envelope of solid metal.

The few dendrites formed grow out into liquid iron of eutectic composition. Eutectic solidification then takes place at many centers or nuclei, which grow to form so-called eutectic cells. During dendritic solidification there is a decrease in the weight of a given volume of metal, resulting in solidification shrinkage similar to that of steel. When eutectic solidification begins, however, growth of graphite within the eutectic cells results in an expansion in the volume of the metal rather than in the shrinkage which takes place during freezing of most metals.

Its Importance—To the foundryman this is important because eutectic irons or the softer hypoeutectic irons may be cast with little provision for feed metal. Although the volume of liquid metal decreases between the temperature at which the metal is cast and the beginning of freezing (liquid shrinkage) and also during dendritic solidification, the low density of the graphite precipitated during the later eutectic solidification causes considerable expansion, which may force liquid into shrinkage cavities already formed. Thus, castings made in soft irons often are gated with little provision for feeding. On the other hand, castings poured in high-strength irons of low-carbon equivalent may require rather heavy risering due, at least partially, to the smaller amount of graphitic expansion accompanying the freezing of less eutectic.

It has been generally accepted that to feed a casting successfully the riser must remain molten longer than the casting. In actual practice, however, risers which do not meet this requirement have often appeared to perform satisfactorily. Pellini (Fig. 10) has demonstrated that, in a rigid mold, a riser which remains open until dendritic solidification is complete often is adequate since graphitization during the later eutectic stage of freezing results in sufficient expansion to prevent formation of shrinkage defects at this time.

The above, of course, assumes a rigid mold. Actually, in a mold made of clay-bonded sand, evapora-

Fig. 11—Microstructure of phosphoric gray cast iron. Etched in 4 per cent picric acid in alcohol, X 100. Light gray formations are steadite *(Typical Microstructures of Cast Iron)*

tion of water and vitrification of the bonding clay may cause contraction to take place at the surface of the mold while coking of seacoal and expansion of silica work in the other direction. Thus, iron is not poured into a mold having a cavity of constant volume but rather into a cavity which changes in volume while the iron still is fluid enough to follow these changes. It has been amply demonstrated that this matter of mold wall movement is a particularly big factor in the production of shrinkage defects in iron castings and that green sand molds, being less rigid than molds of dried sand, are likely to be particularly troublesome.

Effect of Phosphorus — During solidification of many cast irons we encounter not only the iron-carbon eutectic but another eutectic of iron and phosphorus known as steadite, the light gray formations shown in Fig. 11. Steadite freezes a little above 1700° F and contains about 10 per cent phosphorus. Because of its low freezing temperature, this is the last constituent to become solid during the freezing of cast iron so that it is found concentrated in a network around the eutectic cells.

TABLE I—Effect of Phosphorus on Internal Porosity*

Phosphorus, Per Cent	Void Volume, Cu Cm
0.015	0.35
0.035	0.43
0.073	2.12
0.104	2.62
0.123	2.96
0.74	12.75

*Timmons' data.

Due to its rather low concentration of phosphorus, a small amount of this element forms a large amount of the low-melting segregate. While phosphorus is widely used in light-sectioned castings for its beneficial effect on fluidity, it has been demonstrated that in complicated castings the low freezing temperature of steadite permits it to drain from locations which, because of the design, may be hot spots in the casting, causing unsoundness at such locations.

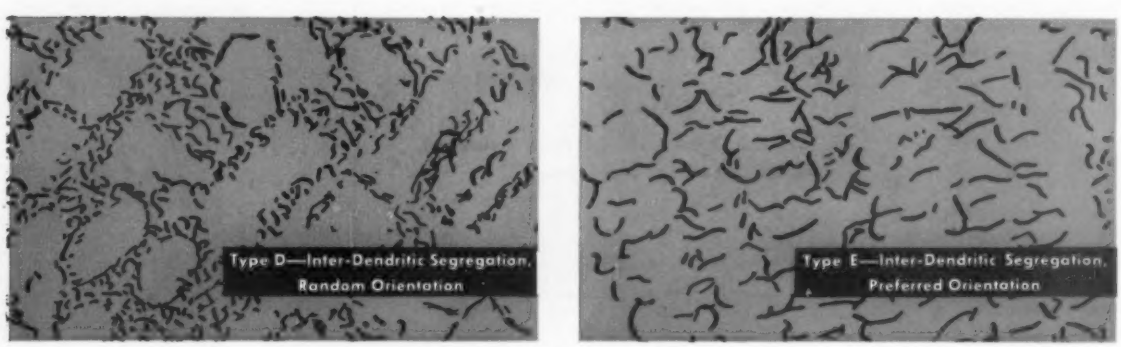
Timmons has reported that the amount of unsoundness in unfed 4-in. cube castings increased progressively as the phosphorus content increased. This is indicated in Table I. During recent years there has been a decided trend toward lower phosphorus iron in automotive foundries and others producing complex castings; today many such foundries melt irons of under 0.10 per cent phosphorus.

Effect of Inoculation—Since 1930 it generally has been recognized that the flake graphite in the structure of a cast iron may occur in somewhat different forms, also that certain types of graphite are preferable if the iron is to have maximum strength and satisfactory resistance to wear.

The graphite flakes in iron of a given analysis can vary greatly in the size of the individual flakes, depending largely on the rate of solidification as governed by section thickness. They also can vary in their distribution from random dispersion to distributions in which flakes are partially or entirely segregated between the dendrites formed during solidification.

Since graphite has little or no strength in tension and exists in large volume, it is not surprising

Fig. 12—Types of graphite distribution from ASTM Graphite Flake Type Chart. Graphite distribution affects the properties of a cast iron



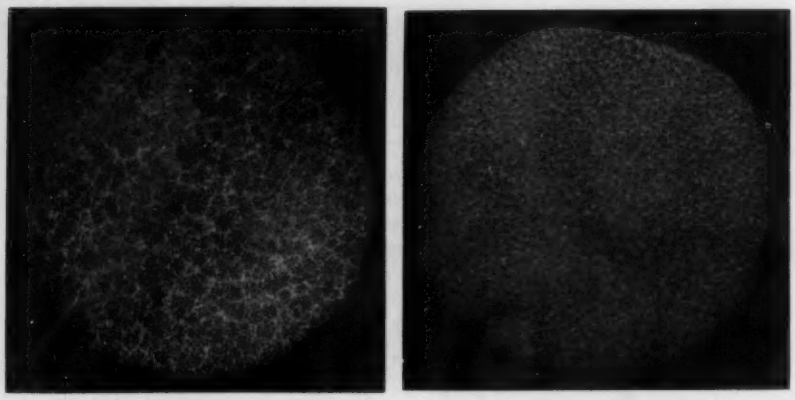


Fig. 13—Left, coarse eutectic cells in uninoculated iron containing 3.10 per cent C and 2.00 per cent Si, X 3. Right, fine eutectic cells in an inoculated iron of the same composition, X 3

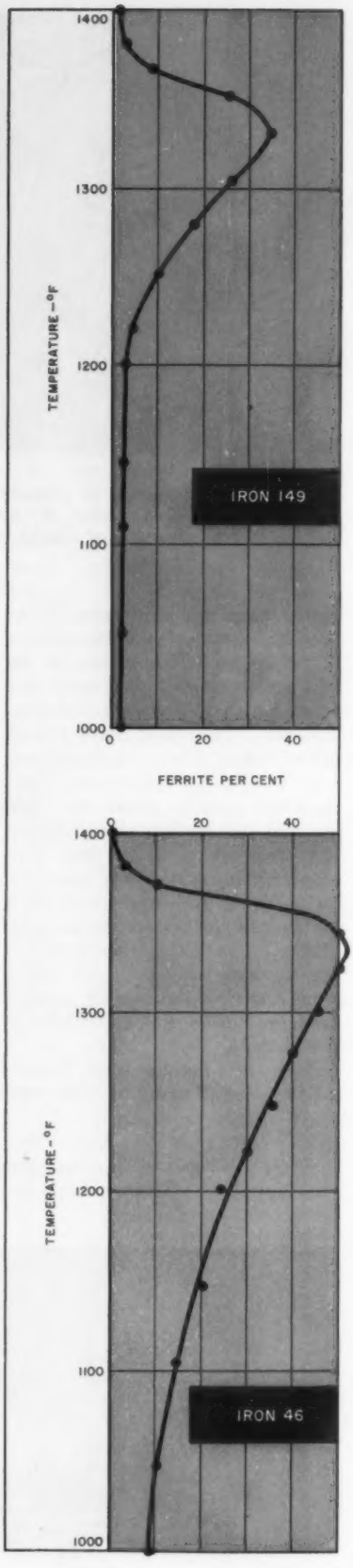


Fig. 14—Amount of ferrite formed in 5 min at various temperatures. Specimens of about 3.00 per cent C and 2.20 per cent Si quenched from 1600°F into lead bath. *(The Structure of Cast Iron,* Boyles)

that the distribution of this constituent has a great effect on the properties of a cast iron. This effect readily is realized when we consider that the matrix of a pearlitic cast iron has a tensile strength of some 120,000 psi, which may be reduced to 35-40,000 psi by the presence of the graphite in the structure. For most applications, graphite of random dispersion is preferred. Type A, shown in Fig. 12, is an iron containing such graphite. It has better properties than metal of similar analysis containing segregated graphite of the D and E types shown in the same illustration.

Boyles and others have shown that the types of graphite formed are related to the mechanism by which the iron solidifies. Formation of eutectic cells during solidification of the eutectic apparently is initiated at nuclei. The nature of these nuclei is imperfectly understood, but when they are few in number, solidification of the eutectic begins at few locations, resulting in fewer and larger eutectic cells.

It has been shown that iron of this type undercools during freezing, eutectic solidification beginning at a somewhat lower temperature; also that since solidification begins at few centers, the growth of the cells is rapid, resulting in fine segregated graphite of the D and E types. This type of structure often is called "undercooled" or "eutectiform" and is more common in irons of low carbon equivalent or in sections which freeze rapidly.

Addition of certain materials to the molten metal shortly before casting apparently adds nuclei for eutectic solidification, as shown in Fig. 13. Freezing of the eutectic begins at a slightly higher temperature and at numerous points, resulting in a great number of eutectic cells. Because the time of freezing is similar and solidification is progressing somewhat more slowly at a vastly increased number of points, there is greater freedom for graphite growth, and this constituent forms in a more random distribution.

The influence of graphite type on the properties is magnified further

TABLE II—Effect of Late Silicon Addition on Properties of a 3.10% Carbon—2.10% Silicon Cast Iron*

Iron Number	1	2	3	4	5
Silicon in charge	2.17%	1.50%	1.00%	0.50%	.....
Silicon—late	.....	0.58%	1.15%	1.57%	2.13%
Silicon—total	2.17%	2.08%	2.15%	2.07%	2.13%
Transverse strength	2299 lb	2475 lb	2868 lb	2925 lb	2476 lb
Deflection	0.190 in.	0.242 in.	0.325 in.	0.335 in.	0.248 in.
Tensile strength	37150 psi	42560 psi	47550 psi	48400 psi	39475 psi
Brinell hardness	217	217	212	212	207

*Crosby and Herzig.

by the fact that "eutectiform" graphite tends to be associated with a matrix containing soft ferrite while similar analysis iron containing random graphite usually has a substantially pearlitic matrix.

Materials added for graphite nucleation include calcium-silicon, ferrosilicon, and certain proprietary materials. Effect of the "late" addition of ferrosilicon on the properties of gray iron are shown in Table II. The process of adding such materials to molten iron for control of the structure and properties is known as inoculation and the materials themselves are called inoculants. It is believed their effectiveness results largely from the presence in the inoculant of such reactive elements as calcium, aluminum, and zirconium.

Heat Treatment—Decomposition of austenite containing about 0.85 per cent CE to pearlite at the eutectoid transformation in the neighborhood of 1300° to 1400° F has been mentioned. So also has the fact that such pearlite is somewhat unstable because of the silicon content of cast iron and, depending on composition, will itself decompose to graphite and ferrite. Boyles (Fig. 14) has determined the temperature at which this occurs, and the time involved, by quenching two cast irons of about 3 per cent C and 2.20 per cent Si from 1600° F into a lead bath held at various temperatures for five minutes, the specimens then being removed and quenched in water.

Iron 149 has random graphite and iron 46 contains fine eutectiform graphite of Type D distribution. It will be noticed that there is some formation of ferrite slightly below 1400° F and that down to about 1340° F increasing amounts of ferrite form. Below this temperature decomposition of pearlite is reduced as the temperature falls, particularly in the random graphite iron. The structure of iron 46 containing fine Type D graphite decomposes at a much more rapid rate.

This is an excellent illustration of the reason for selecting many of the temperatures used in heat treating of cast iron as shown in Fig. 15. Stress relief heat treatments take place at temperatures as high as possible while avoiding decomposition of pearlite and reduction in the properties of the iron. This would be about 1100° F for iron 46.

When annealing for maximum machinability we wish decomposition of pearlite at a rapid rate which can be accomplished most efficiently at about 1340° F if the control of temperature is accurate. In much commercial heat treating equipment, it would be safest to heat the castings to a somewhat higher temperature of about 1450° F and to cool slowly from this temperature through the range at which decomposition is most rapid to about 1200° F. If the structure contains massive carbides, decomposition requires higher temperatures in the range of 1650° F.

Quenching treatments for hardening involve heating to a temperature well above transformation to possibly 1600° F or 1650° F, followed by quenching in oil or other coolant. During reheating, partial decomposition of pearlite takes place but above the transformation, graphite again dissolves, bringing the matrix to equilibrium at a carbon content depending on the temperature to which the castings are heated for quenching.

These last two treatments sometimes are combined; the casting is annealed to ferrite to permit easy machining, after which the carbon content of the matrix is restored by soaking at about 1650° F, followed by a quenching treatment for hardening and resistance to wear.

In flame or induction hardening the time at temperature usually is too short to cause either a great deal of decomposition during heating or much replenishment of carbon by resolution of graphte at higher temperatures. Hardness obtained by such treatments thus depends mostly on the combined carbon content of the iron and the nature of the quench employed for hardening.

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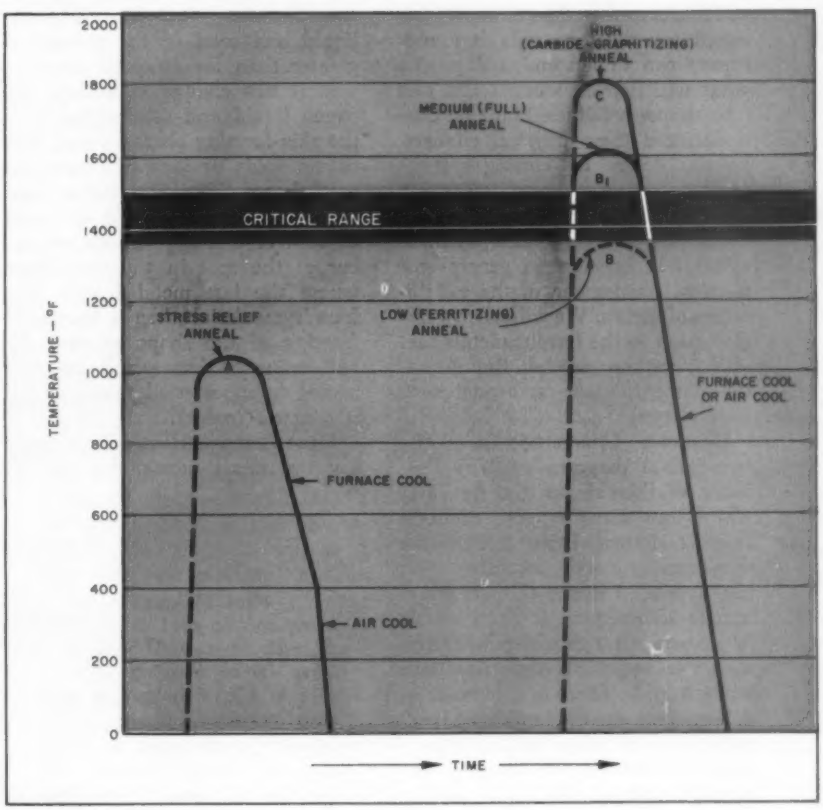
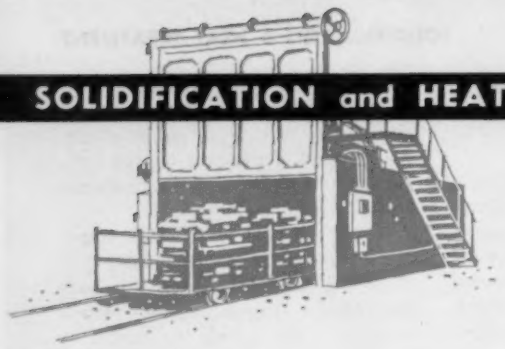
Fig. 15—Recommended annealing cycles for gray iron (curves B, B_1, and C) as compared with stress-relief cycle (curve A), according to Vanick





SOLIDIFICATION and HEAT TREATMENT

Steel and

● DIRECT CONVERSION of liquid metal into usable shapes is one of the oldest manufacturing processes. Unfortunately, for the good of the foundry industry the many complex physical changes that occur between the liquid metal and the final shape have not been well understood. Only within the last 20 years has some basic understanding of these phenomena been established.

Thanks to the effort of many dedicated investigators, today's foundryman can understand and predict what will happen when metal cast into shapes solidifies. Since he does understand these physical changes, he can design his casting systems to produce shapes second to none in usability and reliability.

The article by Professor Wallace (Page 84) explains in general the physical phenomena of the solidification of metals. We will narrow our discussion to the ferrous metals that solidify without precipitating graphite—namely, steel and malleable (white iron).

Common Characteristics — The iron-carbon diagram used by Professor Wallace shows that steel and white iron have several common freezing characteristics: 1. Both are skin-forming metals. Steel, however, has stronger tendencies than white iron in this respect. 2. Both metals freeze over a range of temperatures, with steel requiring less range than white iron. 3. There is a decrease in volume between the liquid and solid metal in both cases. In the case of steel, this decrease is about 3 per cent whereas for white iron the decrease is approximately 4½ per cent.

The principal difference between the freezing of these two metals is in the carbon content of the last metal to freeze. Steel never has any of the eutectic of austenite and cementite formed, whereas in the case of a 2.50 per cent white iron almost 30 per cent of the original liquid freezes as the eutectic. This fact accounts for the greater decrease in volume when white iron freezes since the change in volume between liquid and solid of the eutectic is greater than for austenite alone.

It is this change in volume between liquid and solid metal, plus the skin-forming characteristic, that causes voids or lack of density in cast shapes. The iron-carbon diagram clearly shows that the void or lack of density will always occur at the spot in the cast shape where the last metal froze. The foundryman's job then is to control freezing of the shape so that the last point to freeze will be connected to an external source of liquid metal (feeder).

Must Remove Heat—Since freezing the metal necessitates the removal of heat, any successful feeding system requires an understanding and control of heat removal. As a steel or malleable casting cools in the mold, 20 heat units per pound must be removed for each 100°F the metal is cooled while it is still liquid. At the same time 1 per cent of its volume must be supplied to replace the normal contraction during this cooling. Then, as the metal solidifies, 144 heat units per pound must be removed even though the temperature is not reduced below the final freezing point.

During this freezing the metal will lose 3 to 4½ per cent of its volume. By some means at least 3 per cent of the original metal volume must be fed into the mold if a solid casting is to be obtained. As the casting cools below its freezing point, 16.5 heat units per pound per 100°F must be removed. The removal of these last named heat units, however, is important only as they affect removal of heat from other parts of the casting which may not yet have solidified. Fig. 1 illustrates the heat which must be removed to cool steel from 100°F

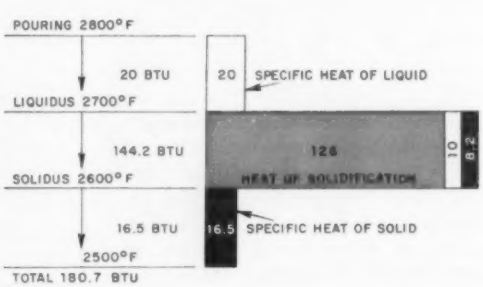


Fig. 1—Heat liberated during cooling of 1 lb of steel from 100° F above initial freezing point to 100° F below final freezing point[1]

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above its initial freezing point to 100° F below its final freezing point.

Sand and chills are the common media for removing heat. Fig. 2 shows the relative amounts of heat which these two materials will absorb and transmit per unit of time. As illustrated, sand has such poor heat absorbing and transmitting properties that the casting will remain in the solidifying range for an appreciable length of time.

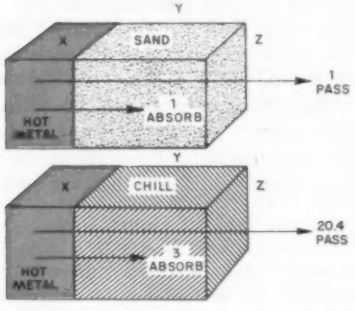


Fig. 2—Comparative amounts of heat sand and chill will transmit and absorb per unit time[1]

The 3 to 4½ per cent change in volume between liquid and solid metal occurs only as the metal freezes, so that any feeding medium used must be able to wait until sufficient heat has been removed to cause all or part of the casting to solidify. In other words, the feeder must wait until the casting wants metal. Since heat also is being removed from the feeder, the size of a feeder must be governed by how long it has to wait and how much feed metal the casting wants. Hastening the freezing of the casting, or retarding the freezing of the feeder, will aid production of solid castings with a higher yield because the greatest part of the feeder is used to overcome the waiting period.

Feeding Objective—The objective of any feeding system is to control the time when every section of a casting solidifies so that every part of the casting, as it freezes, will be connected to a source of liquid metal. This is a matter of controlling the rate of heat removal.

Basically the rate of heat removal for any given molding medium is determined by the ratio of the surface area to the volume of the section. This statement is true where simple shapes are concerned since the volume of a section determines the number of heat units which must be removed, and the surface area determines the amount of molding medium available to absorb or transmit this heat.

As the design of the casting becomes more complicated, this simple statement fails to express properly the rate of heat removal. Fig. 3 shows, by the direction and number of arrows, the path of heat as it travels into the molding medium and the relative number of heat units removed in a given time. The rate of heat removal is determined

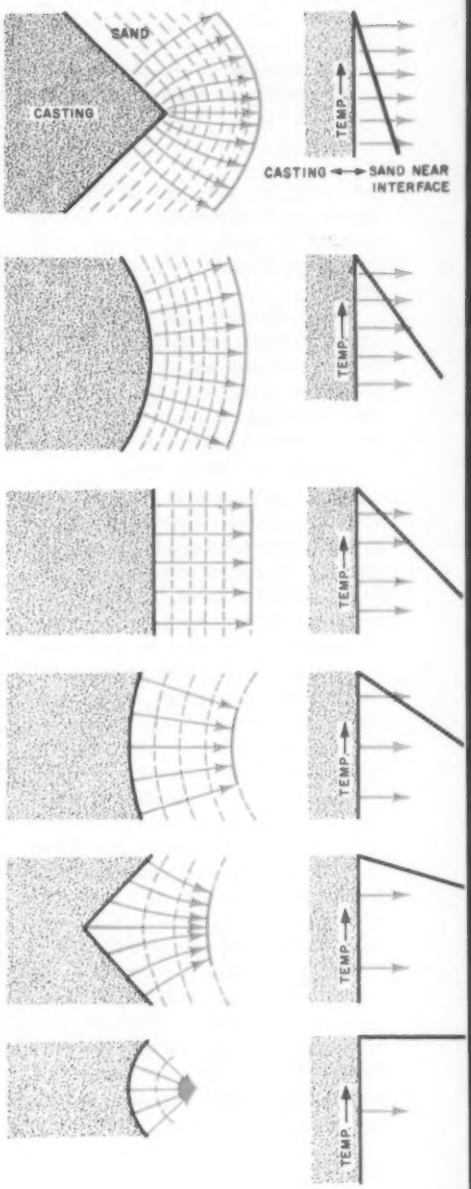


Fig. 3—Contours and spacing of isotherms (dotted lines), path of heat flow (arrows), and relative thermal gradients and rate of heat flow (arrows)[2]

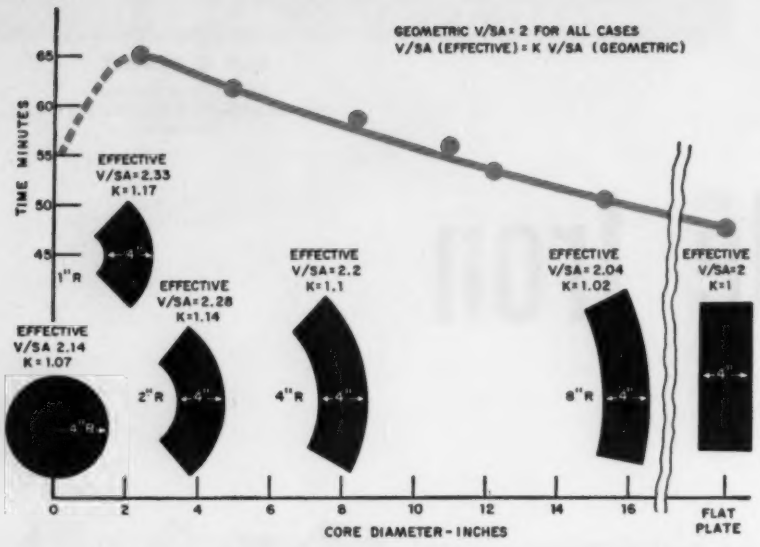


Fig. 4—Relation of solidification time to core diameter.[2] Shrinkage conditions cannot always be improved by coring out heavy bosses

not only by the area of sand in contact with the metal, but by the volume of sand back of the mold interface available to absorb the heat.

Fig. 4 illustrates the freezing time (rate of heat removal) of several sections, all having the same ratio of volume to surface area, and shows why foundrymen have at times failed to improve shrinkage conditions by coring out heavy bosses.

These illustrations demonstrate the limitations of any empirical formula which attempts to calculate the size of feeder required to produce a solid casting by merely associating the ratio of surface area of the whole complicated shape and its volume, to the surface area and volume of the attached feeder. The feeder must supply liquid metal to the casting section which has the lowest rate of heat loss (last section to freeze) so that the rate of freezing of the feeder (ratio of surface area to volume) must be slower than that of the last casting section to freeze, and may not bear any relation to the ratio of surface area to volume of the casting as a whole.

Here's a Way To Do It—Any complicated cast shape is a combination of bars, plates, and cylinders whose solidifying characteristics are known. Foundrymen can determine, by mentally dividing any casting into solidifying centers, whether the design can be made solid and how to control the freezing and feeding of every solidifying center.

Recognition of whether a given casting can be made solid is the first and most important step. There is no good reason why designers of structural shapes should not be told that there are certain natural characteristics of metals as they solidify, characteristics that must be considered if freedom from injurious shrinkage is expected.

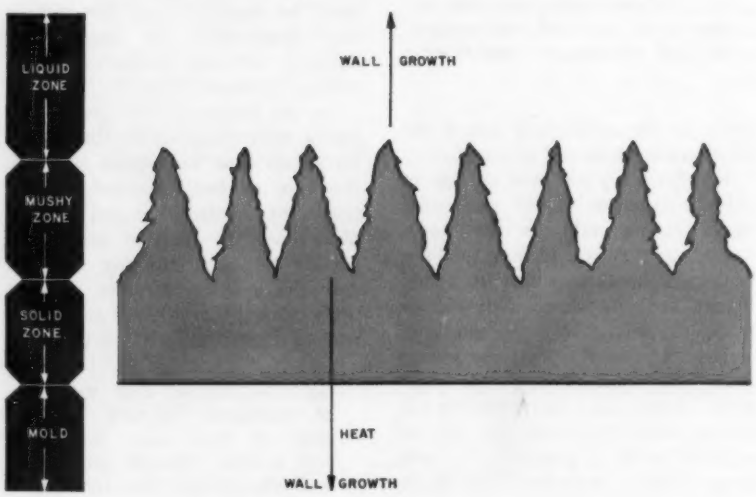
For example, it is not economically possible to cast a plate section of uniform thickness free from centerline shrinkage if the width and length of the plate is greater than certain fixed dimensions. Changing from a uniform plate thickness to a tapered section eliminates much of this difficulty.

In designs with varying section thickness, each section as it freezes must be connected to some source of liquid metal. The most satisfactory way to accomplish this objective is to build it into the design and not try to cover the casting with feeders as external sources of needed liquid metal.

Good gating and proper use of chills can establish temperature gradients to control the freezing rate of various sections. Why not familiarize designers with these natural characteristics and enlist their aid in designing shapes which will take advantage of all the inherent good qualities of the casting process and, at the same time, be easy to produce?

How Metals Freeze—The solidification of metals such as steel and malleable iron starts with the growth of pine tree dendritic crystals. The wall of any casting in the early stages of solidification is illustrated by Fig. 5, which shows a solid zone adjacent to the mold wall, then a zone of pine tree crystals surrounded by liquid metal, and then a zone of liquid metal. Rapid

Fig. 5—Dendritic wall growth during early stages of solidification.[3] Rapid heat extraction decreases the length of the dendrites



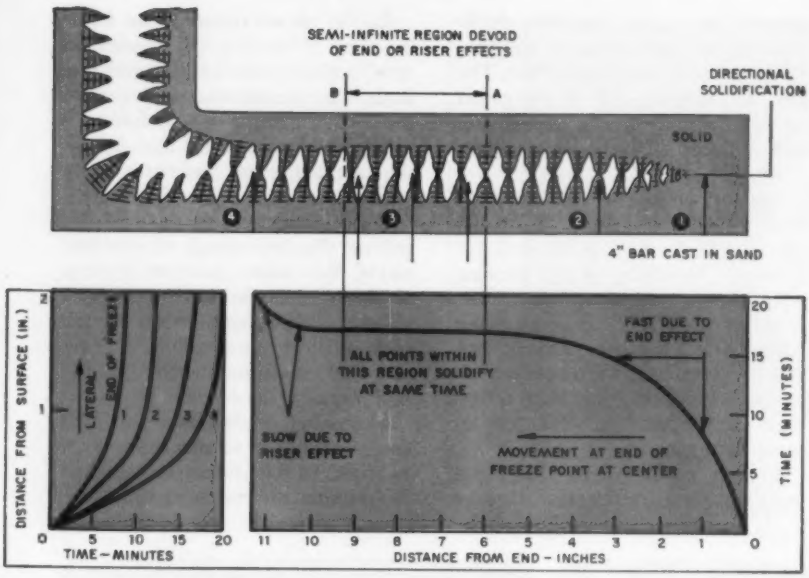

SEMI-INFINITE REGION DEVOID OF END OR RISER EFFECTS
B
A
DIRECTIONAL SOLIDIFICATION
SOLID
4" BAR CAST IN SAND
DISTANCE FROM SURFACE (IN.)
LATERAL END OF FREEZE
TIME – MINUTES
ALL POINTS WITHIN THIS REGION SOLIDIFY AT SAME TIME
FAST DUE TO END EFFECT
SLOW DUE TO RISER EFFECT
MOVEMENT AT END OF FREEZE POINT AT CENTER
TIME (MINUTES)
DISTANCE FROM END – INCHES

Fig. 6—Mechanism of directional solidification represented by varying rates of solidification at various positions in the casting[1]

heat extraction decreases the length of the dendrites so that the greater the ratio of surface area to mass, the shorter the dendrites will be.

To understand what happens during the freezing of a complicated shape, we must first understand the freezing of a simple shape such as a bar or plate. Fig. 6 illustrates a bar with a feeder at one end. Freezing starts at the end away from the feeder since the metal at this point is the coldest, heat being extracted from the end and both sides. Cooling of the other end is retarded by heat stored in the feeder.

To produce a solid casting, the freezing of this section must progress from the cold to the hot end in such a manner that an open channel exists to convey liquid metal from the feeder to any part of the section when it freezes.

As more and more metal freezes at the cold end, the V-shaped tip of the remaining liquid metal travels toward the feeder. As this tip travels farther from the end of the casting, less and less heat is absorbed by the end until point *A* is reached where almost all the heat is being extracted by the sides of the section. Between points *A* and *B* all the heat is being extracted by the side walls so that all points within this region freeze at the same time.

The cold end effect which produced the V-shaped tip of liquid metal traveling toward the feeder is gone. Since point *B* solidifies at the same time as point *A*, the channel for liquid metal to travel from the feeder through point *B* to point *A* also is gone. As a result, shrinkage will occur in the center of the section between *B* and *A*.

Heat stored in the feeder has retarded freezing of the metal between it and point *B*. After the freezing of the whole section passes point *B*, the V-shaped tip of remaining liquid metal is regained and the desirable condition of a wave of solidification progressing toward the feeder with a channel for liquid metal always open between the feeder and the tip of the V is resumed.

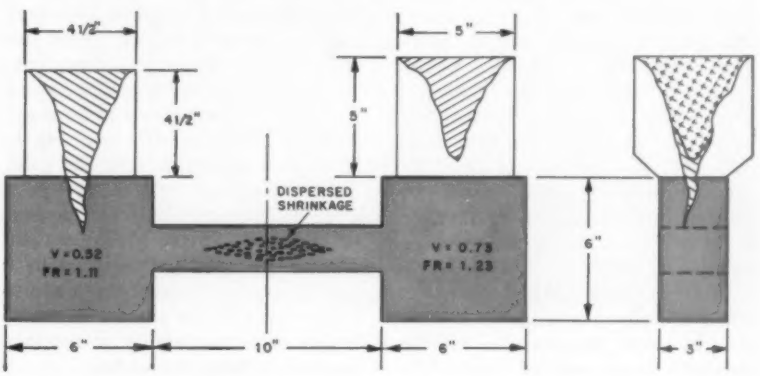
End Effect Is Important—If the cold end does not exist naturally, it can be created by: 1. Tapering the section so that the thinnest part will be farthest from the feeder. 2. Placing a chill at the point where a cold end is desired. 3. A combination of both.

The total amount of heat which must be removed to make any section solidify is governed by the amount of metal in the section, and the rate of removal is governed by the surface area. A tapered section varies the amount of metal (heat) in the section without changing the surface area to any extent. Thus, a freezing wave which starts at the thinnest point and progresses to the heavy end can be established.

Fig. 7 illustrates two kinds of shrinkage in a casting. At left the shrinkage, which runs from the feeder into the casting, is the result of lack of sufficient liquid metal in the feeder to supply needs of the casting. The dispersed shrinkage in the thinner center section cannot be eliminated by increasing the size of the feeder, as illustrated in the righthand section, because this dispersed shrinkage is caused by an attempt to feed a uniform section, without a cold end, for too great a distance.

This casting must be considered as having two feeding centers. The heavy end sections are feeders for the thin connecting web. Freezing must start from the center of the web and progress to the heavy ends.

Fig. 7—Left, shrinkage results from insufficient metal in the feeder to supply needs. Center, shrinkage results from lack of cold end effect[4]



To start this freezing wave in the center of the web requires that the section be tapered from the ends to the center, or that a chill be placed in the center of the web to produce an artificial cold end.

Sections joined at right angles to form L or T junctions present a more difficult problem. Fig. 3 shows why this is true. The rate at which heat can be carried away from the metal cast as a flat plate is twice as fast as from a 90-degree re-entrant angle.

Fig. 8 illustrates the freezing rate of L and T sections; note that there is no solid metal at the apex of the re-entrant angle until most of the flat sections are frozen. Formulas developed by the Naval Research

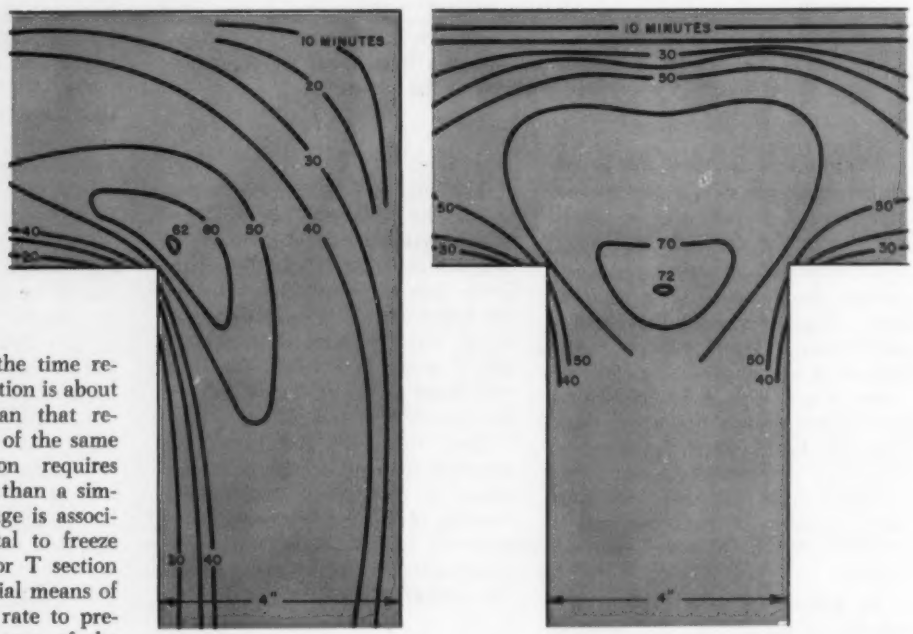


Fig. 8—Progression of end of freeze wave in solidifying L and T sections.[2] These intersections should be avoided when possible

Laboratory show that the time required to freeze an L section is about 1 1/3 times longer than that required to freeze a plate of the same thickness. A T section requires about 1½ times longer than a similar plate. Since shrinkage is associated with the last metal to freeze in any casting, the L or T section will require some artificial means of accelerating its cooling rate to prevent shrinkage at the apex of the angle.

Investigators have calculated that a fillet with radius equal to or at least one-half the plate thickness will assist materially. Fig. 4, however, shows that a radius of almost twice the plate thickness is needed to produce a cooling rate nearly equivalent to that of a flat plate. Although the proper use of chills can overcome the natural characteristics of this type junction, the L or T intersection should be avoided wherever possible.

Effect of Chills—Fig. 9 shows the effect of chills of varying thicknesses on the time required to solidify varying thicknesses of steel. Obviously, increasing the chill thickness above a certain point will produce very little beneficial effect. The general opinion of investigators seems to be that a chill thickness of from 0.7 to 1 times section thickness is adequate.

Pouring temperature, however, affects solidifying time, as shown in Fig. 10. More time is required for a section to solidfy as the pouring temperature increases. Since the lines for final solidification remain almost parallel, this increase in time should have very little effect on feeding. However, the time difference can be used to advantage in some castings.

In the cases where the metal must run for a considerable distance in the casting cavity, it is possible to increase the cold end effect by pouring rather hot. The metal loses heat to the mold as it travels toward the end of the mold cavity. Consequently, metal at the points farthest away from the gate or feeder will be much colder and thus solidify more rapidly than the metal nearer the gate. Thus, a temperature gradient equivalent to tapering the metal section is produced. Such a temperature gradient can not be produced in a chunky section because the thermal conductivity of the metal is so much higher than our ability to conduct heat away from the section.

Fig. 11 shows the effect on freezing time of varying the amount of sand between the casting and the flask. The nearer the casting is to the flask the faster it will freeze. A simple explanation of this fact is that air and metal flasks are better conductors of heat than is sand.

Possibly the best example of forgetting the importance of this factor is the rather common practice of placing a feeder in the corner of a flask. Although the feeder should cool as slowly as possible, it is exposed to conditions which make it cool rapidly.

Designing a Feeder—The first consideration is to determine how to make it stay liquid longer than the casting. Since, when all other conditions are equal, the rate of heat loss is determined by the ratio of surface area to volume, a geometric shape having a very low ratio should be selected. Such a requirement suggests a sphere. Even though spheres are difficult to use, the nearer that shape is approached the better.

In a sphere, the height equals the diameter. Most feeders are cylinders since this is a convenient and efficient shape. If the height is greater than the diameter, the diameter controls the rate of freezing. The height is important only because it permits control of the volume of

liquid metal available to feed the casting.

An oversimplified example of this concept is the problem of feeding a 4-in.-square bar 12 in. long. The casting is to be poured in steel with 200°F superheat, so the total volume change will be 5 per cent. Assume that the rate of cooling of the casting and the feeder will be the same. A 4-in. cylinder will freeze at the same rate as a 4-in. square bar, so the feeder must be larger than 4 in. in diameter. The volume of the square bar is 192 cu in. and 5 per cent, or 9.6 cu in., of feed metal must be supplied. Metal also must be supplied to feed the metal frozen in the feeder. If a safety factor is provided, the additional metal will be about 9.6 cu in., or a total of 19.2 cu in. If the feeder is made 6 in. high, then 19.2 cu in. divided by 6 in. = 3.2 sq in. which is the area of a 2-in. circle. Thus, the feeder needs to be 4 in + 2 in. = 6 in. in diam and 6 in. high.

Heat Treatment—The rate of solidification of both steel and malleable iron is one of the factors which determines the length of time required to heat treat or anneal the material satisfactorily. In general, as the size of the original austenite crystals increases, the time at temperature must be increased. This is true particularly for malleable iron, since the size of the cementite crystals increases as the cooling rate decreases, with the result that considerably more time is required to decompose these large cementite crystals than would be required if the cooling rate had been faster and the cementite crystals smaller.

Lack of solidity due to insufficient feeding can cause considerable difficulty in heat treating. There is a tendency for the low melting point constituents to segregate in the last metal to freeze. These impurities or alloys often interfere with or even prevent proper heat treatment.

REFERENCES

1. W. S. Pellini, "Practical Heat Transfer," *Transactions*, AFS, Vol. 61, 1953, p. 603.
2. F. A. Brandt, H. F. Bishop, and W. S. Pellini, "Solidification at Corner and Core Positions," *Transactions*, AFS, Vol. 61, 1953, p. 451.
3. H. F. Bishop and W. S. Pellini, "Solidification of Metals," FOUNDRY, February 1952, p. 86.
4. J. B. Caine, "Risering Castings," *Transactions*, AFS, Vol. 60, 1952, p. 16.
5. H. F. Bishop, F. A. Brandt, and W. S. Pellini, "Solidification of Steel Against Sand and Chill Walls," *Transactions*, AFS, Vol. 59, 1951, p. 435.

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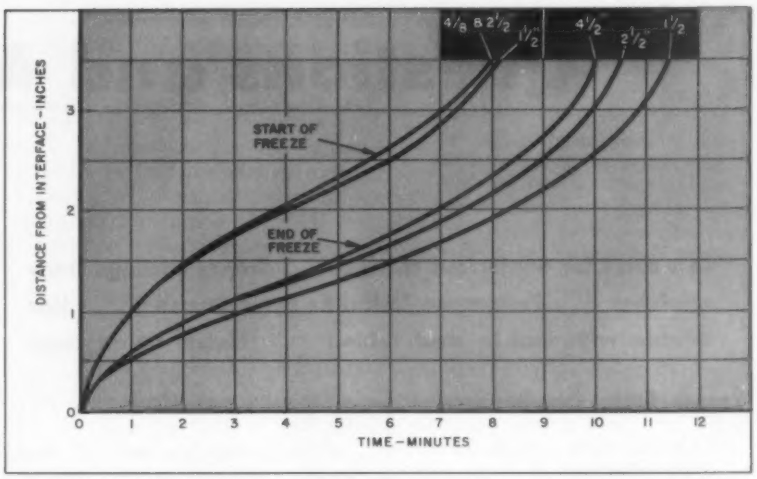


Fig. 9—Effect of chills of varying thicknesses on the time required for solidification of various thicknesses of steel[5]

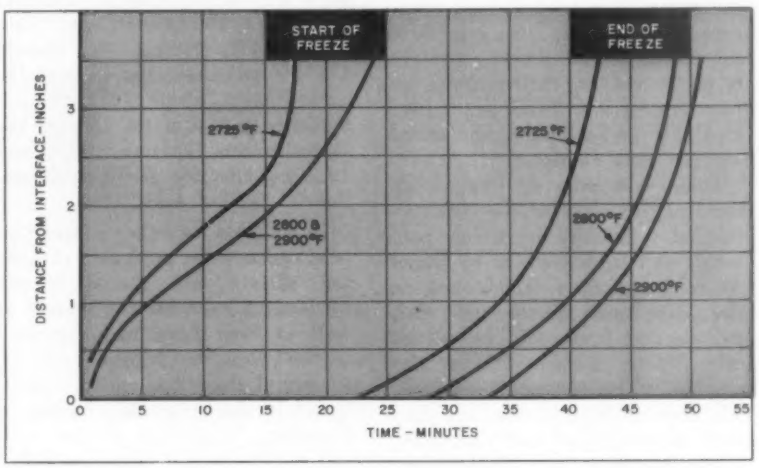
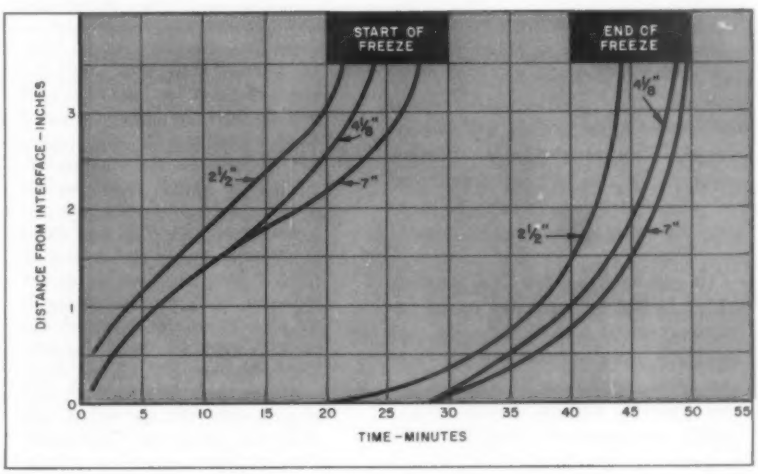


Fig. 10—Pouring temperature affects solidifying time of steel in sand molds.[5] As temperature increases, more solidification time is required

Fig. 11—Effect of varying the amount of sand between the casting and the flask on the solidification of steel[5]



Questions and Answers

CO_2 cores for nonferrous castings . . . Bronze castings show splotches . . . Permanent flatbacks are expensive . . . Has trouble with cast-in steel tubing . . . Needs dense cores

Frozen Cores Can Be Used

Can you advise us where we can obtain information on frozen sand cores for use in a nonferrous foundry?

Although we suspect your reference to frozen sand cores applies to the carbon dioxide process, it might be mentioned that molten metal has been poured into frozen green sand molds without difficulty, and sound castings were obtained.

Some time prior to 1936, when the Russians reported the construction of a foundry in which both molds and cores were to be frozen by refrigeration, a foundryman in the Northwest discovered that molten cast iron could be poured into frozen molds without any trouble. The situation developed when an extreme temperature drop and failure of the foundry's heating system caused a floor of green sand molds left overnight to freeze.

The foundry superintendent shuddered at the thought of destroying the molds and, possessing considerable curiosity, decided to try pouring a mold or two to see what would happen. With the hearty co-operation of the employees standing at a safe distance from the bold venture, the pouring of several molds was accomplished without incident. The remaining molds were handled by the regular crew, and the castings were found to be as good as those poured under normal conditions.

To get back to the CO_2 process, which is being employed to an increasing extent in making cores and molds, it involves the use of clay-free sand bonded with 4 to 6 per cent sodium silicate. After being formed into cores or molds the sand is hardened by injection of carbon dioxide for a relatively short period of time.

The process has received considerable attention in the literature, and some of the recent articles in FOUNDRY include: "CO_2 Cores Reduce Production Costs," October, 1956; "CO_2 Molds and Cores," February, 1957; "What You Should Understand About the Carbon Dioxide Process," June, 1957; "Developments in Use of the Carbon Dioxide Process," March, 1959, and "Factors Affecting Sodium Silicate-Bonded Sands," April, 1959.

In addition, specific information is available from producers of sodium silicate and special silicate binders designed for the process as well as from firms manufacturing carbon dioxide. Names and addresses of these companies may be found in the advertising section of FOUNDRY.

Spots Appear on Cast Bronze

In our production of bronze markers and tablets we run into an occasional casting which will not oxidize completely. Trouble is indicated by a splotchy appearance, even on the sandblasted surface, which occurs at odd intervals. Alloy is 90 Cu, 6 Sn, 3 Zn, and 1 Pb, and purchased as certified mill analysis ingot not made from scrap. Another local foundry with another metal supplier has the same trouble.

Metal is melted in a No. 70 crucible in an oil-fired furnace. It is deoxidized with 1 oz per 100 lb of phosphor copper and poured at 2200° F from the crucible and a preheated small crucible. A standard 12 x 24 in. size is poured two up with gates on the 24-in. side. Metal thickness is 3/16 in. Some molds are made in Albany 00 sand sprayed with milk and baked, and some are made in CO_2 molds. Trouble occurs regardless of the molding method. The melt is stirred well before pouring, and aluminum and silicon bronze contamination is guarded against.

Polishing or sanding on the blotchy spots shows a gray or silver colored appearance right down into the metal. This trouble occurs on only about 10 per cent of our castings and is hard to pin down.

Difficulties which occur sporadically always are hard to trace to the source, as you indicate. They require close attention to details as well as some sharp detective work. Examination of the affected areas under the microscope might reveal a clue, or perhaps fracturing the casting would supply the answer. Again it might be necessary to mill fine shavings from the blotchy spots and subject them to chemical analysis.

From your description of the gray or silver appearance it sounds as though aluminum or silicon contamination exists at times, but in such cases the tendency is for the coloration to appear over the whole surface rather than in isolated areas. It is possible, however, that the aluminum oxide or lead silicate resulting from the contamination is trapped in the vicinity of the gates. The coloration may be tin-sweat resulting from a gassy condition of the metal in combination with high temperatures.

You mention that the metal is stirred well before pouring; this practice should be omitted unless you let the molten metal stand for some time before pouring. Strong or violent stirring entrains fine inclusions and dross in the metal, and sufficient time must be allowed for them to agglomerate and rise to the surface. Although it may not have any bearing, we suggest that you increase the phosphor copper addition to 2 oz per 100 lb metal.

To obtain the most satisfactory results in coloring castings—or oxidizing as it commonly is termed, but which actually is providing a

sulfide coating—the casting surface must be clean. Steps in cleaning include:

1. Immerse the castings in a boiling 5 per cent caustic soda bath for 15 minutes. 2. Rinse thoroughly in running water and pickle in dilute nitric acid solution (1 part commercial acid to 50 parts water) for 5 minutes. 3. Immerse castings in a sulfide bath composed of 20 per cent commercial ammonium polysulfide diluted with an equal volume of water.

Casting Should Be in Drag

We are setting up an ornamental aluminum casting commonly referred to as a flatback. We would like to know if it is possible to have a permanent drag to save the labor of repeatedly making flatbacks in sand. Casting is to be made in the cope.

Although you may have reasons for making the ornamental casting in the cope, we believe you will be better off to make it face down in the drag. That will insure less trouble with defects on the face of the casting. Use a fine sand to obtain as smooth a surface as possible, and employ sufficient gates to eliminate any drawdowns or shrink spots on the back of the casting. Cope, of course, will be a flatback.

Various types of permanent flatbacks can be used, but we believe that all will be more expensive than squeezing up a flatback in green sand.

You can use cast iron plates, which would have to be purchased. The plates would have to be coated with some type of refractory wash or paint and dried thoroughly before use.

Slab cores would be another method, or use of flatbacks made of a cement-sand mixture.

Cast-in Tubing Is Problem

We are having difficulty in making copper castings with cast-in steel tubing in that the tubes seem to split inside the casting. The latter has a 3-in. face, is ¾ in. thick, and an ID of 12 in. Tubing is about ⅜-in. diam with 1/16-in. wall. We tried seamless steel tubing filled with coarse sand, and copper was poured at 2300° F.

It is our opinion that the difficulty with the steel tubing is not splitting but cutting caused by molten metal flowing over the affected portions for too long a period. We suspect that the casting is gated so that the molten copper impinges on the thin tubing sufficiently long to destroy it.

Obvious remedy is to increase the number of gates so that the quantity of metal flowing through any one is not great enough to cause cutting of the tubing. Possibly the present gates could be rearranged so that direct impingement would be eliminated.

Also we suggest that you try pouring the copper at a lower temperature. We believe that castings of the section thickness mentioned can be poured successfully at a temperature under 2200° F.

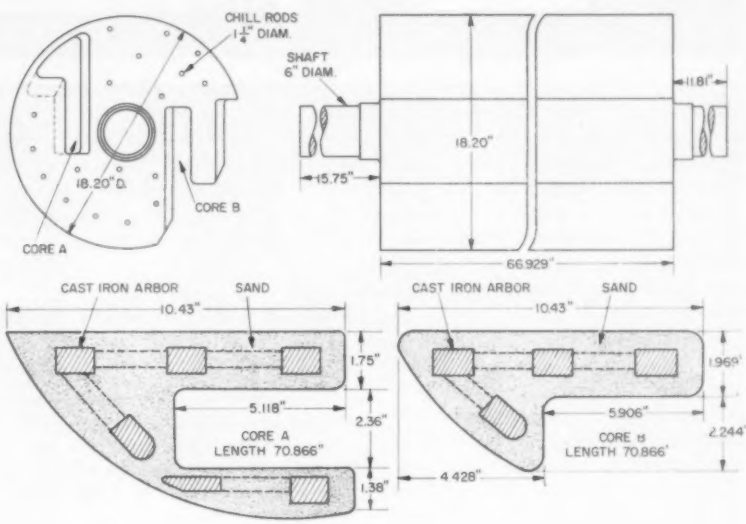
Dense Cores Must Be Employed

We have a casting problem in our foundry in Brazil which we hope you can help us solve. The part to be cast is a steel cylinder shown in the drawing. It has two cores, A and B, one of them partially on the surface and the other entirely inside the casting. The part is supposed to be cast so that the two shafts at each end form an integral part of the casting.

The cores and the shaft make it difficult to use risers of proper size to feed the casting. The shaft, however, could be incorporated by either 1) machining and inserting a forged shaft as the cylinder is finished, or 2) by casting the cylinder with a forged shaft of 6-in. diameter and of the proper length inside the casting. The 6-in. shaft and the chills of 1¼ in. of soft steel would simplify the risering problem, but we wonder if results would be successful.

The main problem, however, is the core B. We are afraid that this core, due to its length, will not withstand the heat and pressure it will be subjected to as the part is being cast, and that either the sand will burn before the casting solidifies, or that due to the amount of heat, the expansion of the cast iron reinforcement (arbor) will cause the sand to break loose.

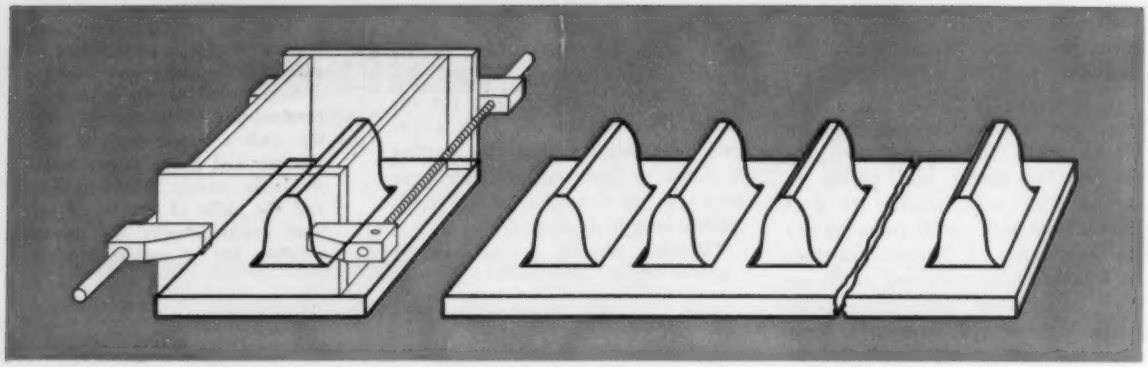
Please tell us which sand composition you would advise and the correct reinforcement (arbor) to use.



Large cast steel roll, showing cores which must withstand metal pressure

The problem of metal penetration into the small core can be minimized, if not solved, by using a dense core. A core sand containing 30 to 40 per cent −200 mesh silica flour added to an AFS 45-55 mesh silica sand should take care of penetration. These sands can be bonded with most core binders other than oxidizable oils.

One and one-half per cent dextrin, 3 per cent western bentonite, 2 per cent iron oxide is one com-



Left—Making plaster piece mold. *Right*—Producing a gang mold

bination of binders that can be used with 30 to 40 per cent silica flour. These dense cores must be well vented and well baked. It would be best to experiment with some smaller cores in smaller castings before making the larger cores and castings.

Irregular cast iron arbors are not used generally for cores in steel castings, and it is not known if the irregular shape of the iron arbor will promote cracking due to differences in expansion. Four $1\frac{1}{2}$-in.-diam rolled steel rods should reinforce this core if the casting is poured with the cores placed vertically, and this spacing allows room for vents. No reinforcement will hold the core straight if the mold is poured in the horizontal position. Large hold down rods, at least 2-in. in diam, will be needed in this case, extending through the casting and cope to rigid bearing plates clamped to the cope flask. If the end use of this casting requires a perfect outer diameter, the hold down rods, if used, must be flame cut, or chipped out and the areas welded sound.

Cleanliness of the outer diameter also dictates that this casting be poured vertically. The riser should be attached to the side of the casting, even though this complicates riser removal and requires a larger flask. The center shaft can then be cast as an integral part of the casting. A cast-in shaft is not recommended due to danger of hot tears around what is in reality a noncollapsible core.

If the shaft extensions are made part of the casting, the junctions should be made with at least 3-in. radius fillets. Consideration also should be given to externally chilling these junctions unless past experience has shown no harmful hot tears in these areas. The core prints for both cores should be $\frac{1}{2}$ to 1 in. longer than the cores to allow for expansion during casting.

Forming Teeth in Epoxy Resin

In the June issue of FOUNDRY the article on "Making Epoxy Coreboxes from Patterns" aroused our interest to the extent that we would like to experiment with the material, and will appreciate information on sources of supply and technical data.

One of our main problems is in the production of wood patterns for cast-tooth crownwheels where each tooth is made by hand and fastened to the body of the pattern. If the rate of production on these teeth by the use of epoxy resin can be increased substantially, we can effect a considerable savings in pattern time.

Questions we would be concerned with mainly are 1) rate of resin solidification; 2) comparative costs with present methods, and 3) could a demonstration be arranged?

The literature on use of epoxy resins in production of patterns and other applications indicates lower costs than with other methods of fabrication. From your description it appears that you should benefit considerably by employing resins or plastics in making the cast-tooth crownwheels or gears.

Two approaches to this operation are: 1. Make one master tooth and from it make sufficient epoxy resin duplicates for the wheel or gear. These teeth are fastened to the pattern body by adhesives or other methods. 2. Make the whole pattern in epoxy resin. Since a variety of these resins, with and without fillers possessing different properties, are made by the same and different manufacturers, only the general procedures will be described. Details can be obtained from the resin producers.

For only reproducing the teeth the procedure would be to mount the master wood tooth on a board and make a number of plaster or gypsum molds. The number of molds required will depend on such factors as the number of teeth desired, time allotted for production of the teeth, characteristics of the resin such as gelation and curing times. For example, if the resin characteristics were such that it could be removed from the mold in 2 hours, then it could be used to make four teeth in 8 hours.

Instead of making individual molds for production of the teeth, a gang or multiple-cavity mold to make any number of teeth can be produced in plaster. The mold of the master tooth is used to cast plaster replicas of the tooth which are mounted on a board and invested with plaster. After the plaster is set, the teeth are removed.

For production of the crownwheel or gear as a single epoxy pattern, we believe the simplest method would be to cast the proper number of plaster replicas of the master wood tooth and mount them in the proper position on a board. Next invest them with plaster. After the plaster is set, the teeth are removed, resulting in a multiple-cavity mold with the cavities in proper alignment. Body of the gear is made as a separate mold by investing the proper wood form with plaster, or sweeping one from stiff plaster.

US RUBBER FOUNDRYGIANT CONVEYOR BELT

Tramp Iron can't go on a TEAR on this belt!

Hot foundry sand loaded with jagged pieces of tramp iron is a murderous combination for a conveyor belt.

That's why this leading Southern foundry uses U. S. FoundryGiant *RipStop* Conveyor Belts. These special heat-resistant belts have rip-stopping wire ribs imbedded in the carcass across the belt at 3' intervals to prevent the jagged pieces of metal flash, sprues, gates, geigers, etc., from going on a tear and wrecking the belt. Where previous belts lasted only 2 or 3 months, the "U. S." belts are lasting 8 times as long!

Two FoundryGiant cotton-nylon belts convey the tramp-infested hot sand from both the shakeout and sand-slinging unit to storage bins. These thinner belts, made possible by the considerably stronger cotton-nylon carcass, allow for much more efficient tramp iron removal by keeping the load closer to the core of the magnetic field of the head pulley.

"All in all," says the master mechanic of this smooth-running foundry, "these belts save us about 500 man-hours a year in belt repair and replacement. We're very happy with their performance."

• • •

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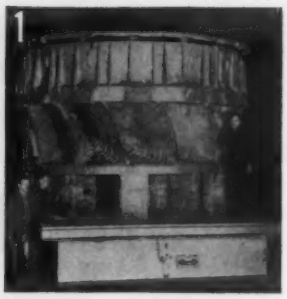

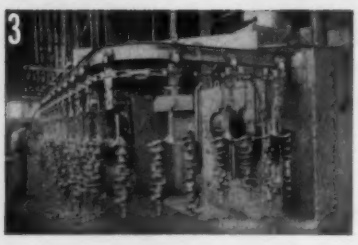

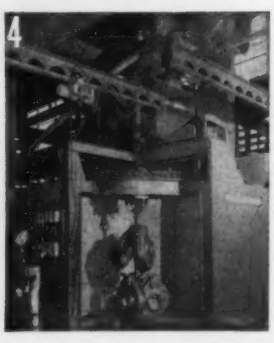

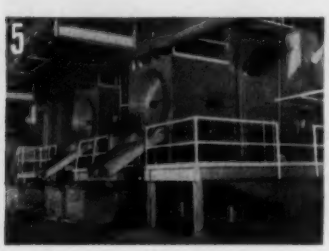

1. 70-ton casting, more than 16′ in diameter, cleaned in a Wheelabrator Car-Type Room.
2. Wheelabrator Swing Tables provide versatility in cleaning large and small castings.
3. Cleaning Shell Molded Crankshafts at production line speeds.
4. Versatile Spinner Hanger Cabinet handles wide range of castings.
5. No man-hours needed for cleaning in Wheelabrator Continuous Tumblasts.
6. Wheelabrator Monorail Cabinets clean large and relatively intricate castings at high production rates.

For the solution of your cleaning problem, you have at your disposal the richest background of practical cost-saving ideas in the blast cleaning industry. And the list of applications continues to grow as Wheelabrator research probes and explores to find better ways to solve industry's blast cleaning and finishing problems.

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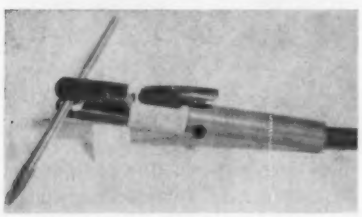
For More Information
Use Reply Card—Page 53

What's New in Equipment and Supplies

METAL REMOVAL TORCH

A pushbutton air control valve in the torch handle adds to the convenience of the model M-5 Arcair torch. Other features of the torch include molded, heat-resistant jaw insulators; molded plastic



upper arm lever; a heavier, heat-resistant silicone sleeve on the front part of the torch handle; and a silicone shield on the torch head to protect it from extreme heat. The power connection on the concentric cable assembly is covered with a protective rubber boot to prevent accidental arcing while the torch is in use. Up to 5/8-in. diam electrodes can be used in the torch. —**Arcair Co.**, Box 431, Lancaster, Ohio.

For More Details Circle No. 450—Page 53

VACUUM SYSTEM

Ultra-high-vacuum system attains pressures of 1×10^{-9} mm Hg or better within a chamber having adequate space for production or extensive experimentation. The stainless steel work chamber 12 in. in diam by 18 in. high is equipped with two 2-in.-diam windows, rotary motion, and electrical feedthroughs.

The work chamber is enclosed in a mild steel outer chamber with two mating 2-in. observation ports and is fitted with heating elements and radiation shields and wrapped with water cooling coils. Differential pumping permits the use of simplified seals.—**Kinney Mfg. Div., New York Air Brake Co.**, 3529 Washington St., Boston 30, Mass.

For More Details Circle No. 451—Page 53

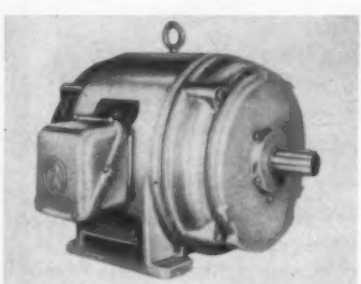
PLASTIC PROPORTIONER

Measuring device simplifies weighing of resin and hardener. This proportioner is designed to allow automatically for the weight of the container or resin mixing cup. Proportioning is determined by adding required quantity of resin, then turning dial face and adding necessary hardener or catalyst.—**Plaster Supply House**, Box 551, Chicago 90, Ill.

For More Details Circle No. 452—Page 53

DRIPPROOF MOTOR

Rerated 364U frame and larger dripproof ball bearing KZK motors



provide maximum protection against entrance of falling particles or dripping liquids. The motor frame is symmetrical and offers sturdy cast construction. The diagonally split conduit box provides ample room for line lead connections, even with low voltage supply.

Circulation of ventilating air within this motor frame is controlled by a series of integral cast baffles. Cooling air moves in a clockwise spiral direction which is said to assure equal cooling for all portions of the stator core and winding, regardless of the direction of rotation.—**Fairbanks, Morse & Co.**, 600 S. Michigan Ave. ,Chicago 5, Ill.

For More Details Circle No. 453—Page 53

TENSILE TESTER

Model TE-10 is a vertical bench-mounted tensile tester that can be

converted easily to compression tests. A 1/6-hp motor and a small hydraulic pump supply pressure to the hydraulic cylinder behind the hydraulic loadgage at the top of the tester. Loading is controlled by a manual valve. Capacity of the tester is 10,000 lb.

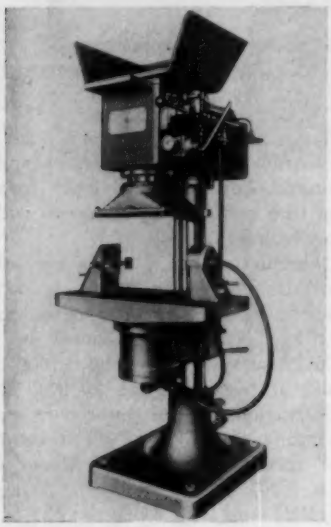
The lower jaw holder is adjustable to three positions, and the

unit can accommodate any length of specimen up to 7 in. It is supplied with one set of jaws and a motor wired for 110-volt, single-phase, 60-cycle alternating current. —**Steel City Testing Machines, Inc.**, 8817 Lyndon Ave., Detroit 38, Mich.

For More Details Circle No. 454—Page 53

CORESHOOTER

Economy model coreshooter for cores up to 17 lb is available with



either standard or vibratory sand feeder. The sand reservoir is stationary and uses no agitators. Shot heads and side clamps can be changed easily, and the table adjusts rapidly. Column of the machine is available in any length.

Operation of this unit is with one lever. Raising the lever fills the machine with sand, and lowering the lever fills the corebox. Wooden coreboxes can be used.—**Hansberg Shooters Inc.**, 3213 Central St., Evanston, Ill.

For More Details Circle No. 455—Page 53

GUEST GOGGLES

Inexpensive guest goggles are said to be an effective solution to the problem of protecting eyes of visitors to industrial establishments. Molded of optical quality Tenite propionate plastic, they deflect grindings, small pebbles, dust, and other particles that might damage the eye. Weight is less than 1 oz, and the goggles are claimed to be comfortable to wear either by themselves or over most prescription glasses. They are available in clear or green lenses with matching frames and can be imprinted with the company name.—**Sellstrom Mfg. Co.**, Palatine, Ill.

For More Details Circle No. 456—Page 53

VIBRATOR MOUNTING

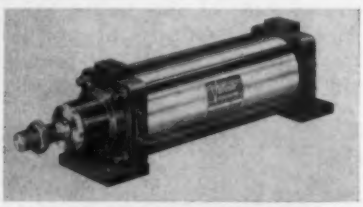
RC-5 electric vibrator features vise-lock mounting with 2½-in. jaw opening. The vibrator can be obtained with a 9-ft, heavy duty cable and is water and dust-tight. It delivers a 275-lb punch and can move, loosen, screen, and package hard-to-move materials. The unit weighs

39 lb and is powered by a three-phase, 60-cycle current from 110 to 550 volts.—**Cleveland Vibrator Co.**, Cleveland, Ohio.

For More Details Circle No. 458—Page 53

HEAVY-DUTY CYLINDERS

Extra-long bronze rod bearings with length-to-rod diameter ratios



of up to 2:1 are said to provide maximum rod stability and resistance to side-loading deflection. These air and hydraulic cylinders feature cartridge-type rod wiper and rod seals, Teflon piston wear strip, removable port adapters, and interchangeable, removable mountings.

The cylinders are offered in a wide range of bore sizes, with stroke lengths to suit individual application requirements, and in a choice of six mounting types-foot, clevis, pivot, flange, adjustable trunnion, or threaded nose. They are built to JIC standards and are rated at 200 psi air and 500 psi hydraulic.—**Valvair Corporation**, 454 Morgan Ave., Akron 11, Ohio.

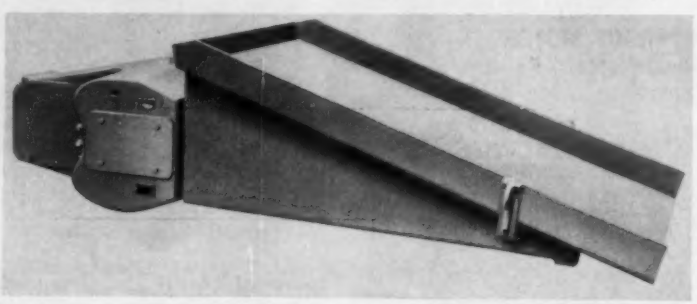
For More Details Circle No. 459—Page 53

GAS-FIRED INTAKE UNITS

Direct fired-intake units supply tempered outside air to replace air removed by industrial exhaust system by burning natural or propane gas in a line-of-flame burner directly in the entering airstream.

Basic models are rated at 2, 4, and 6 million Btu per hour, with air volume of 25,000, 50,000, and

Vibrating Feeder Has 1000-Ton Capacity



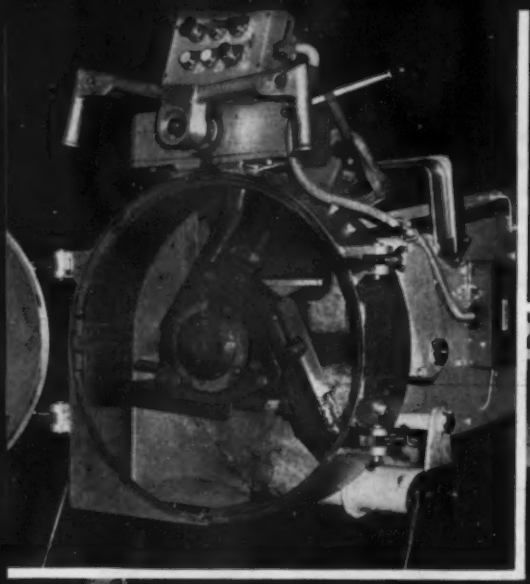
Model 6-D vibrating feeder, with a capacity up to 1000 tons per hour, is designed for the heaviest kind of duty. It is claimed to be ideal for feeding controlled tonnages from bins or hoppers to processing equipment.

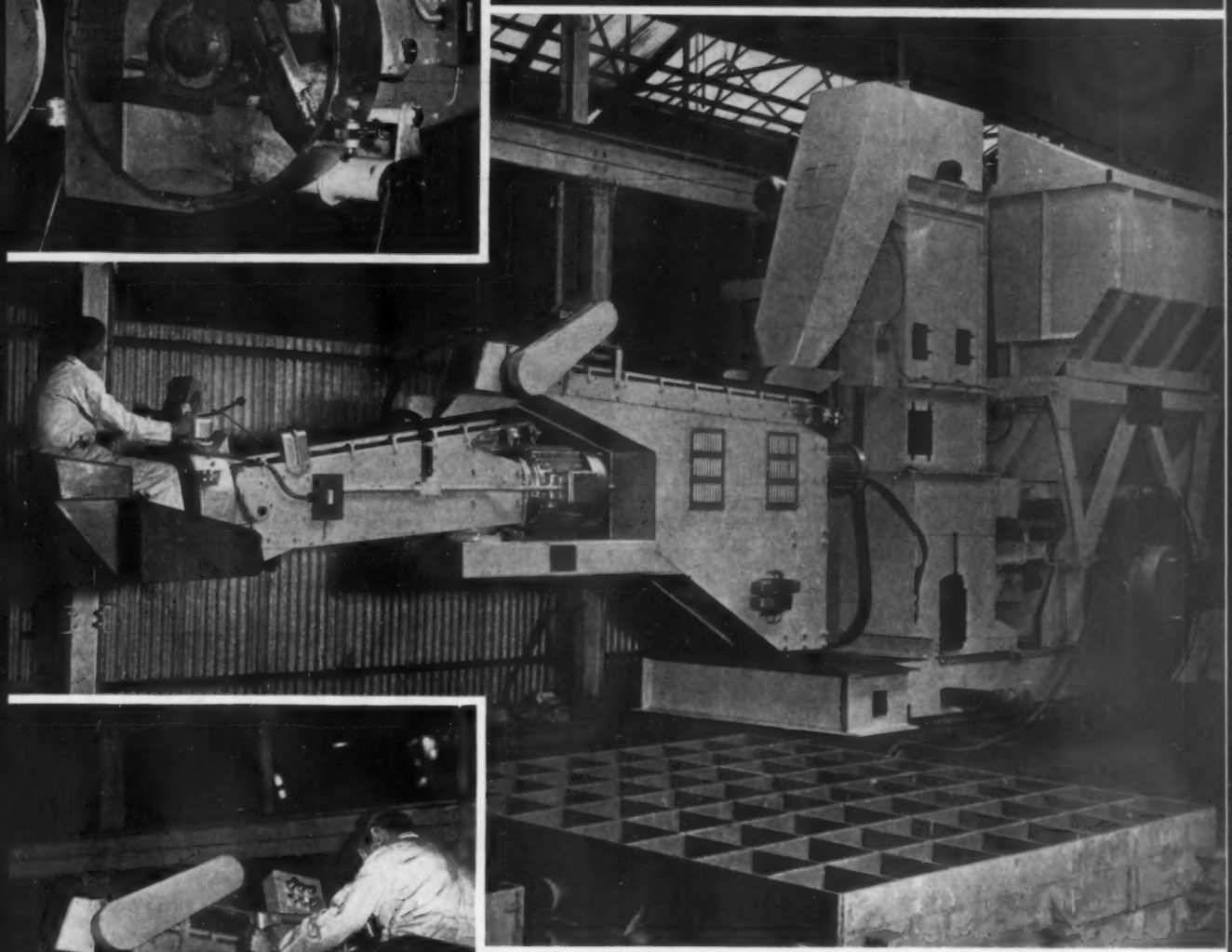
Feeder is equipped with 60 x 90-in., open pan deck and renewable wear-resistant liner. It can be furnished with various deck styles.—**Jeffrey Mfg. Co.**, Columbus, Ohio.

For More Details Circle No. 457—Page 53

Circle 616 on Page 53→

No. 4 Mobile SANDRAMMER





FENAL's newest contribution to Sandramming Practice! This self-powered No. 4 Mobile has Patented 24" "Turbo-Ram" head. Operating radius is 15'. Feed unit includes 7½ ton drop bottom tank and spare tank, with full automatic control from head. Output up to 2000 lb. per minute. This model is also designed as a stationary unit. Our No. 3 Sandrammer has a 10' radius, with head operated by hydraulic power or remote control. If super size work require them, longer jibs are available.
U. S. and Canadian Patents granted. Additional Patents Pending.

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75,000 cfm. They may be installed on the roof or in a wall opening and used with or without a duct system for air distribution.

Standard models have a propeller fan mounted in the air stream, but vaneaxial, tubeaxial, or centrifugal fans for external mounting also can be supplied.—**Hartzell Propeller Fan Co.**, Piqua, Ohio.

For More Details Circle No. 460—Page 53

METAL RECLAIMER

Machine is designed to recover brass, bronze, copper, aluminum, zinc, tin, and lead from dross, skimmings, and sweepings. The electrically-driven unit crushes the refuse and discharges reusable metal from the side. Oxide wastes are collected in a container at the bottom of the machine. Material which cannot be crushed is removed from the machine by reversing rotation of the crusher drum. Reclaimer is available in ten sizes with hourly capacities of 33 to 1300 lb for brass, 22 to 980 lb for copper and bronze, 26 to 1090 lb for aluminum, and 44 to 2640 lb for zinc, tin, and lead.—**Steinlein & Kunze GMBH**, Maschinenfabrik, Koblenz-Metternich, Germany.

For More Details Circle No. 461—Page 53

BUCKET ELEVATOR PULLEYS

Welded steel bucket elevator pulleys feature accurately roll crowned pulley rims for easy belt tracking. Two types are available: Face widths up to and including 13 in. wide are made with one center disc; pulleys with wider faces are made with two discs and two hubs. Both types are said to be light, strong, true-running, and easily cleaned.

Center discs are corrugated so that belt pull stresses at the hub section are dissipated. Hubs, saw-slit through one side, have accurately machined, tapered shoulders which match the inside tapered bore of the discs. Six or eight high-tensile bolts pull each hub into its mating disc and clamp the pulley to its shaft with a permanent grip.—**American Pulley Co.**, Philadelphia, Pa.

For More Details Circle No. 463—Page 53

REMOTE EXHAUST

A remote exhaust feature in high-speed die grinders helps to

eliminate the usual sources of operator discomfort. This feature is possible as motors are throttled by controlling the exhaust rather than the inlet. This design provides full flow to the inlet with minimum pressure drop.

As a result of the remote exhaust, chips are not blasted back at the operator or scattered over a wide area. Oil mist does not accumulate on the operator's hands, clothes, or goggles. Sound is reduced greatly because the length of the exhaust hose functions as a muffler.—**Thomas C. Wilson, Inc.**, Long Island City, New York.

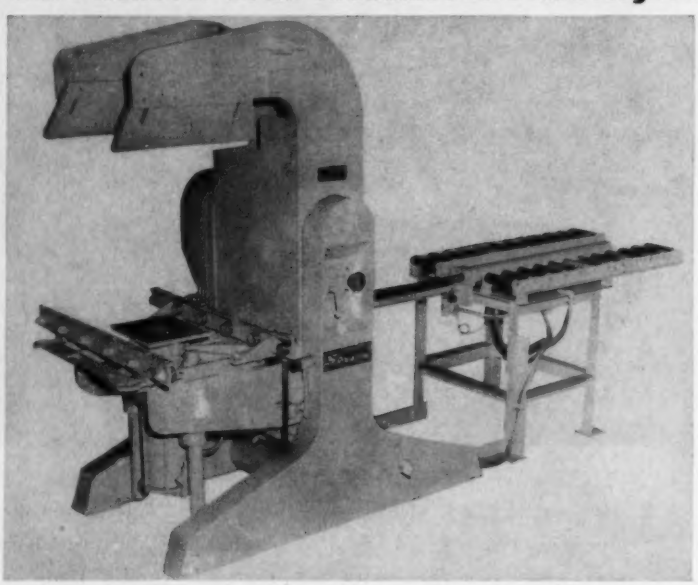
For More Details Circle No. 464—Page 53

CONDUCTIVITY METER

Heatcheck is a transistorized conductivity-permeability meter which

sorts mixed lots of metal parts. Instrument also is used to test both ferrous and nonferrous metal parts. Measurements are made on any flat

Core Rollover Draw Machines Are Redesigned



Redesigned automatic and semiautomatic Rol-A-Cor machines, NCR 20-10, NCR 25-10, and NCR 30-14, cover capacities from 500 to 1000 lb. Features include rollover action with 7 to 10-second over-all cycle, a control circuit using fewer valves, single pushbutton operation, one-piece steel side frame and base, and improved cushioning with use of 1000-psi rated hydraulic dash pot. Coreboxes can be rolled in or out of machines in any selected combination of 90 or 180 degrees.—**Beardsley & Piper, division of Pettibone Mulliken Corp.**, 2424 N. Cicero Ave., Chicago 39, Ill.

For More Details Circle No. 462—Page 53

Q. What's the difference between an archaeologist and a foundryman?

A. When an archaeologist thinks of AIRFLOATED CLAY, he thinks of LOESS, the fine dust that floats over the Gobi Desert.
When a foundryman thinks of AIRFLOATED CLAY, he thinks of

CEDAR HEIGHTS AIRFLOATED CLAY

Fundamentally, the raw product is a superior bonding clay; the finished product is a result of close laboratory control. CEDAR HEIGHTS AIRFLOATED CLAY is ground extra fine, ground to an almost unbelievable 200 mesh! Moreover, this fine bonding clay is made so carefully and packaged so well, it may be ordered and delivered any week of the year! We'll be happy to inform you the name of your nearest distributor. He also handles our top quality FIRE CLAY and BONDING CLAY. We believe you will find product, delivery and price equally satisfactory.

Ask your distributor or write to us direct for free samples of our products.

CEDAR HEIGHTS CLAY COMPANY

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OAK HILL, OHIO

Circle 617 on Page 53

let's look at the figures

When it comes to choosing the right core oil for making your casting, there are 10 figures to check before making your decision. They are the 10 reasons why there is a grade of Penolyn Core Oil to meet the most exacting requirements of every Foundry and Core Room practice. Look at the figures and you'll—

If you require expert technical assistance or technical data regarding your present or future casting operations, just call the Penola office nearest you. Or write: Penola Oil Company, 15 W. 51st St., New York 19, N. Y.

Penola

specify PENOLYN CORE OIL

for these 10 important casting advantages:

1. Dependable uniformity
2. Concentrated form
3. No obnoxious odor
4. Seepage eliminated
5. No crusting, green mix
6. Always clean working
7. Wide temperature range
8. Polymerized formulation
9. Minimum gas
10. Ample collapsibility

PENOLA OIL COMPANY • NEW YORK • CHICAGO • DETROIT

Circle 618 on Page 53

surface $\frac{5}{8}$ in. in diam or larger in about 3 seconds by touching a hand-held probe to the surface tested. The probe radiates an electromagnetic field which excites eddy currents in the test part. Special probes can be supplied for testing curved surfaces. Instrument dimensions are $5\frac{1}{2}$ x $7\frac{1}{2}$ x $4\frac{1}{2}$ in., and weight is $5\frac{1}{2}$ lb. Leather carrying case is supplied.—**Metrol Inc.**, 17 E. Holly, Pasadena, Calif.

For More Details Circle No. 465—Page 53

HOPPER CAR AIR VIBRATORS

Navco HCP air vibrators for unloading covered railroad hopper cars are designed with exceptionally long piston stroke for maximum amplitude and thrust. The piston is the only moving part. These

units have stainless steel mounting heads for long life and use no body assembly bolts. Their design is said to give continual, effective action. Two models are available. One has a 3-in. piston $14\frac{1}{4}$ in. long, the other a 4-in. piston $17\frac{1}{2}$ in. long. Weights are 68 and 115 lb respectively.—**National Air Vibrator Co.**, 435 Literary Ave., Cleveland 13, Ohio.

For More Details Circle No. 466—Page 53

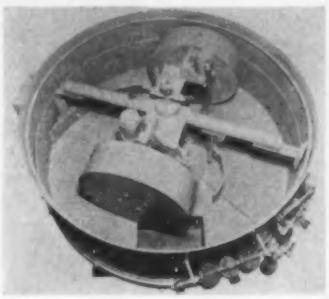
BELT AND DISC SANDER

Heavy duty 10-in. disc and 6 x 48-in. belt sander is made of cast construction with reinforced ribbing for maximum rigidity without vibration. Auxiliary worktable with mitre gage can be tilted 45 degrees and is interchangeable for use with either belt or disc. Preloading belt-tensioning device permits fast changing of belts, and quick-release lever ejects worn belts in seconds. Disc can be operated with or without auxiliary worktable; belt operates in either vertical or horizontal positions. Standard equipment includes worktable, mitre gage, machine pulley, one aluminum oxide belt, and disc.—**Duro Metal Products Co.**, 2651 N. Kildare, Chicago 39, Ill.

For More Details Circle No. 467—Page 53

Muller Mixer Action Provides Thorough Blend

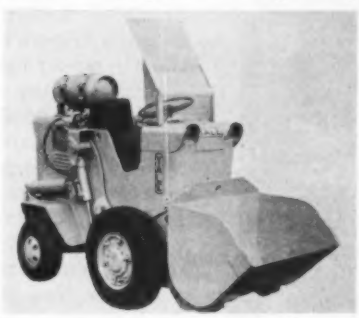
Muller mixer is designed to provide a smearing, spatulating action for more thorough blending. Mullers are hollow, and this light weight cuts down the inertia required to rotate the mullers. Each muller is fitted with either an individual adjustable vertical spring, or an individual air or oil cylinder, which permits a maximum muller pressure up to three times the weight of each individual muller. Vertical shaft in turret and shaft in mullers are fitted with extra-heavy ball bearings. Models are available in 12, 24, and 36-in. sizes.—**International Clay Machinery of Delaware Inc.**, 264 Schenk Ave., Dayton 9, Ohio.



For More Details Circle No. 468—Page 53

SHOVEL MODIFICATION

A modification for the firm's Y-18 industrial tractor shovels fits them for special-duty requirements of the metals industry and the operating



characteristics peculiar to applications around furnaces.

The adaptations include a Protecto-Seal gas tank cap to protect the fuel supply in gasoline powered models. LP-Gas powered models use a $33\frac{1}{2}$-lb ICC container for the fuel. The operator is protected by an angular Plexi-Glas shield on the tractor shovel cowl.

Other safety devices are a safety alarm system of buzzer and flashing light when the shift lever is placed in reverse, directional lights, and a combination stop-tail light arrangement in place of rear operating lights.—**Yale & Towne Mfg. Co.**, 11,000 Roosevelt Blvd., Philadelphia 15, Pa.

For More Details Circle No. 469—Page 53

FAST DISSOLVING ALLOY

Test reportedly shows that 6000 lb of Simplex ferrochrome dissolves in a 70-ton heat in less than 10 min. The alloy is produced in a vacuum furnace, where carbon can be removed easily, and is available with as little as 0.010 per cent maximum carbon.

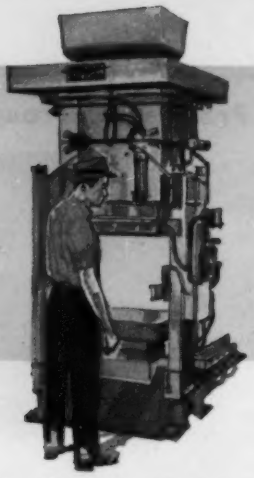
This ferrochrome can be obtained as 1/3-lb pellets or 22-lb bricks. To facilitate handling, the bricks are packed in preweighed steel-strapped bundles or pallet boxes. They can be added directly to the furnace.—**Union Carbide Metals Co.**, division of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y.

For More Details Circle No. 470—Page 53

IRON-LIKE ADHESIVE

Liquid Iron is a puttylike synthetic plastic that sets up into a substance like iron a few hours after it has been mixed with a clear liquid hardener. After it has hardened, it reportedly can be ground, sanded, shaped, filed, or drilled in the same manner as iron. It is said to retain its strength under heat up to 300° F and at cold temperatures down to 0° F.

This adhesive and sealer will dry in the air without heat or pres-



MOLDING PRODUCTION REPORT

What are the advantages diaphragm-head

Report on a new series of high-production, automatic Osborn molding machines that blow, squeeze and strip green sand molds within 12 seconds. Production is rapid, low-cost. Molds are harder, more accurate, more uniform. Series M is the most recent advanced equipment development by Osborn.

AN important forward step has been made in precise quality control of molds—and their rapid production at low cost — with the new Series M Osborn automatic molding machines.

With the new Series M machines, a pre-determined volume of sand is blown into the mold The blow action assures intimate contact between the sand and the pattern. The mold is then squeezed hydraulically to attain the desired degree of hardness—resulting in superior quality molds and superior casting finish. The entire operation is automatic and on preset time cycles. The operator simply loads and unloads flasks.

Model 19-M-2 Middle-range size unit in the series —engineered to produce medium-size molds. All Series M models operate automatically, on preset time cycles.

Model 19-M Smallest of the series—designed to handle production of small, superior quality molds. Mold surface characteristics are outstanding to produce excellent castings finish.

Idea Began 40 Years Ago—Foundrymen first saw the vast potential in sand blowing for forming sand to desired shapes about 40 years ago. Attempts were quickly made to relate the new core sand-blowing methods to green sand molding. But, the expected results never materialized because temperamental molding sand would not behave according to molding and casting rules.

Research Pays Off—Rather than abandon a tremendous potential—The Osborn Manufacturing Company continued application research work on sand behavior in machinery Result of these extended engineering and development efforts is Osborn's new Series M automatic molding machines—rapidly being recognized as the foundry industry's standard because of their ability to produce green sand molds faster, harder, more uniformly and at lowest cost.

Superior Quality As-Cast Finish—The Osborn Series M blows, squeezes and strips green sand molds to meet extremely high quality standards. Resulting castings can be held to closer dimensional accuracy The as-cast finish is outstanding And molds are produced faster than on any other molding machine available today.

Unique New Blow Head—Construction of Osborn's Series M molding machines is extremely simple and compact Operation is based on a new, exclusive type blow head—developed by Osborn. The molding sand flows readily through the blow head when the blow action is initiated. The sand is distributed over the pattern in a manner that assures molds of proper uniformity, density and surface quality.

Hydraulic Squeeze Action—Although the desired blowability of green sand is achieved through the new Osborn blow head—it is the addition of hydraulic squeeze action that accounts for the simple construction and rapid operation.

The machine is arranged so the vertical clamp piston rises and clamps the flask against the blow head. Molding sand

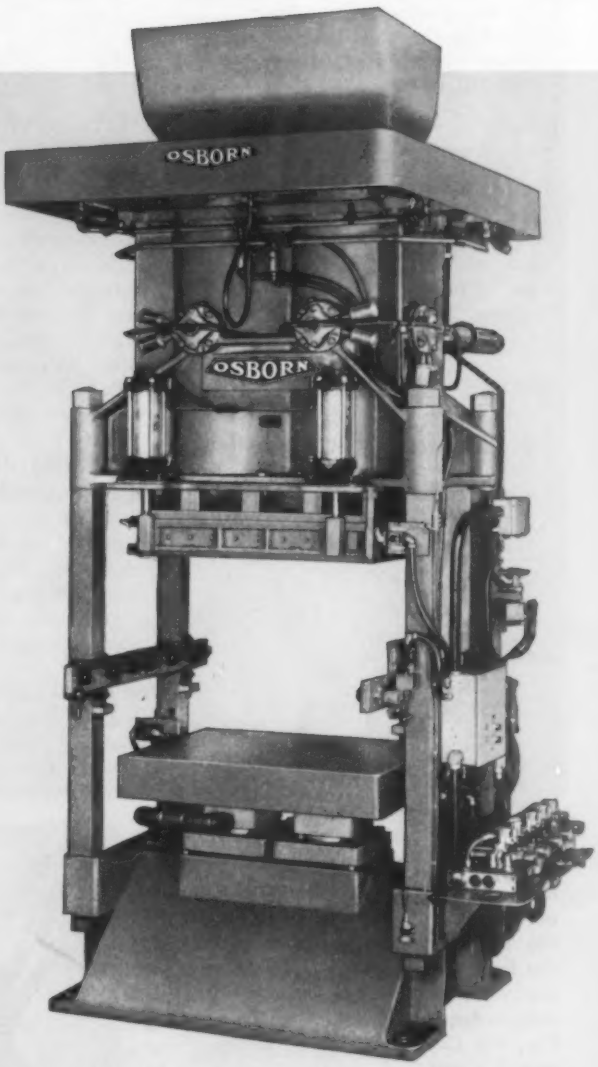
# of Osborn's new blow-fill, hydraulic-squeeze, Series M molding machines

under pressure is blown through the blow opening and spreader which are integral with the squeeze head. With one vertical acting piston, the mold is blown and squeezed to the desired degree of hardness. As the vertical clamp piston descends to the rest position, the mold is stripped.

Controlled Squeeze Pressure—Arrangement of the hydraulic squeeze piston allows complete control of squeeze pressure—while still allowing high-pressure molding if desired. Squeeze pressures are not subject to variations due to fluctuations in the air line supply—nor the air pressure available.

KEY OPERATING FEATURES AND PRODUCTION ADVANTAGES OF THE NEW OSBORN SERIES M

- **Pneumatic Blow Fill** feature produces excellent sand distribution and pre-hardness for each mold.
- **Flexible Diaphragm** or rigid squeeze head available—depending on requirements.
- **Hydraulic Squeeze** action allows a wide squeeze-pressure range—adjustable for various desired high or low pressure levels.
- **Hydraulic Draw Stroke** action occurs during return stroke of the squeeze piston. No separate draw mechanism required.
- **No Sand Spillage** because of blow-type fill. Exact, controlled volume of sand is blown and squeezed immediately—resulting in clean operation.
- **Controlled Fill** considerably increases the efficiency and useable capacity of the sand system.
- **Rapid Cycle Time** . . . mold production cycle is completed within 12 seconds.
- **Minimum of Working Parts** helps keep maintenance at an extremely low level. No shuttling, no indexing. Only major working parts are cut-off plate in the blow head and vertical piston.
- **No Costly Foundations** are required. Support is necessary for only the machine itself.
- **Compact Construction** means only a minimum of floor area is required for operation.



Model 29-M. This unit is designed for large mold production. Flexible diaphragm or rigid squeeze heads are available for all models.

More Details are Available—Development of the Series M units is recognized as a genuinely outstanding molding machine advance for today's keenly competitive market. Osborn's staff of Foundry Specialists looks forward to discussing these machines with you. There are applications for semi-production and even jobbing foundries.

Circle 619 on Page 53

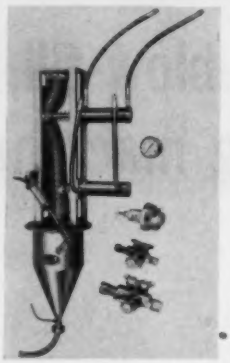
THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Avenue, Cleveland 14, Ohio

Air Cylinders Make Volumetric Bond Additions

Bondadder transporter is designed for volumetric bond additions when space does not permit feeding of bonds or additives into the mixer by gravity. Bonding material is measured into the transporter by air cylinders. The exact point in the cycle at which the bond is to be discharged can be selected either by use of manual pushbuttons or by connecting the solenoid valves to any programming system.

Measuring portion handles additions from 1 qt to 5 qt.—**Harry W. Dietert Co.**, 9930 Roselawn Ave., Detroit 4, Mich.

For More Details Circle No. 471—Page 53

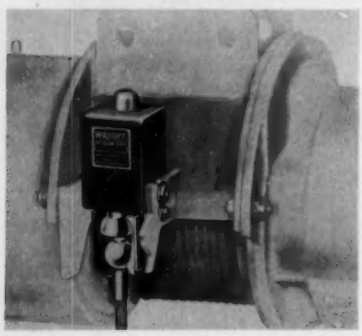


sure. It will bond iron, bronze, brass, and other materials.—**Cycleweld Chemical Products Div., Chrysler Corp.**, Detroit 31, Mich.

For More Details Circle No. 472—Page 53

ELECTRIC HOIST UNIT

Overload cutoff unit on electric hoists is guaranteed by the manufacturer to give dependable, trouble-free protection for its life. The



unit is designed to break the raising circuit of a hoist at the point of overload. This action allows the load to be lowered safely to the floor and unhooked. The raising circuit is restored automatically.—**American Chain & Cable Co.**, 929 Connecticut Ave., Bridgeport 2, Conn.

For More Details Circle No. 473—Page 53

BONDING MOTOR

Ankorite 65 bonding mortar is said to have outstanding properties of refractoriness and durability. This bonding mortor can be used in many applications, including blast furnace bottom blocks and linings, electric furnace roofs, and malleable and air furnace side walls and bottoms. It is reported to have high resistance to slag corrosion and severe erosion of metal and slag at high temperatures.—**Harbison-Walker Refractories Co.**, Pittsburgh 22, Pa.

For More Details Circle No. 474—Page 53

MEASURING INSTRUMENT

Quicktest dial measuring instrument with contacting feeler points determines diameter of internal grooves in difficult-to-measure situations. One leg of the instrument is rigid and the other movable. Distance between extremities of the feelers is recorded directly on a finely graduated dial. Slim, needle-shaped points can be adjusted or replaced if they become worn.

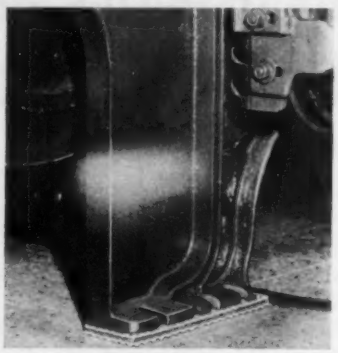
The unit measures diameters of internal grooves from 0.4 in. to 4.0

in. The dial is 2⅛ in. in diam for easy reading.—**Testing Machines, Inc.**, 72 Jericho Turnpike, Mineola, Long Island, N. Y.

For More Details Circle No. 475—Page 53

VIBRATION-ABSORBING PAD

Vibra-Check is claimed to eliminate 90 per cent of the vibrational tremors and noise caused by machines. Pad is durable, reusable,



and impervious to shock or chemicals.

It is able to isolate vibration by a combination of separate layers fused into one product. Its outer layers are of a resilient, low density composition, and the central core is a high-density, hard structure. It conforms to rough and uneven floors. Pad is suitable for machines from 100 lb to 100 tons.—**Lowell Industries, Inc.**, Boston 34, Mass.

For More Details Circle No. 476—Page 53

PUSHBUTTON HOISTS

Budgit pushbutton portable electric hoists are available in capacities from 250 to 4000 lb, each in various lifts, lifting speeds, and single or multiphase currents.

Features include molded fiberglass control handle with comfortable grip and easy-to-use pushbuttons, located in an over-and-under fashion, with an interlock that makes it impossible to depress both buttons simultaneously; multiphase motor currents; control cord with built-in strain reliever cable to permit pulling hoist and load by the control handle; and two positive acting brakes.—**Shaw-Box Crane & Hoist Div., Manning, Maxwell & Moore Inc.**, Muskegon, Mich.

For More Details Circle No. 477—Page 53

CHAINLESS CONVEYOR

Chainless conveyor track is designed to enable pan or pallets to move materials over long distances without transfer points. A clevis attachment, fastened to the bottom of the pan or pallet, bolts directly to the trolley's vertical axles. This ar-

Cupola -tested
for Quality Performance
ABC FOUNDRY COKE

Control-testing of ABC foundry coke for carbon pick-up and melting temperature plays an important part in maintaining that consistent uniformity in quality for which it has long been recognized in the foundry trade.

ABC pioneered this method of pre-checking performance of its coke. Since 1944 it has operated a production size No. 2 Whiting cupola under supervision of its Research Department and service engineers. No laboratory tests can give comparable results in accurately determining coke quality and performance. Results of tests are kept by ABC and furnished customers on request.

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Sales Agents GREAT LAKES FOUNDRY SAND COMPANY, Detroit; ST. LOUIS COKE & FOUNDRY SUPPLY CO., St. Louis; THE RANSON AND ORR COMPANY, Cincinnati; KERCHNER, MARSHALL AND COMPANY, Pittsburgh; BALFOUR, GUTHRIE & COMPANY, LTD., San Francisco; ATWILL COKE AND COAL COMPANY, Chicago.

rangement eliminates pitching or twisting as the pallet is carried above the track. The trolleys are connected by steel rods with ball and socket joints.—**Conveyor Div., American MonoRail Co.**, Fourth and Franklin Streets, Tipp City, Ohio.

For More Details Circle No. 478—Page 53

TRACTOR SHOVEL

Model H-50 is a four-wheel-drive, rubber-tired tractor shovel with

5000-lb carry capacity which replaces model HU. Features include complete power-shift transmission, power-transfer differentials, power-steering, pry-out bucket action, safety boom arms, and power-boosted brakes. Gasoline and diesel engines provide 90 to 92 hp. Large-capacity oil bath air cleaner assures protection of the engine in dusty conditions.—**Frank G. Hough Co.**, 798 Seventh Ave., Libertyville, Ill.

For More Details Circle No. 479—Page 53

BATTERY CHARGERS

Automatic silicon rectifier-type battery chargers with tapering current characteristics maintain proper charge rate from beginning to end of charging cycle. They help to keep batteries performing at peak capability, to assure longer battery life, and to minimize battery maintenance.

This line comes in four physical sizes with a choice of 30 electrical ratings for use with 6, 9, 12, 15, 16, and 18-cell batteries. Ratings range from 250 to 1000 amp-hr. They are designed for charging batteries in eight hours or less, for one, two, or three-shift operations.—**Exide Industrial Div., Electric Storage Battery Co.**, Rising Sun and Adams Ave., Philadelphia 20, Pa.

For More Details Circle No. 480—Page 53

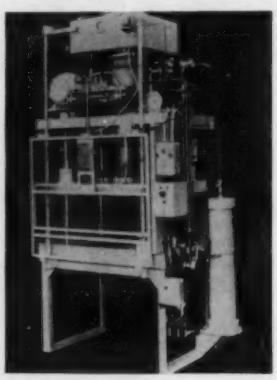
RADIANT ROOF PANELS

Prepiped radiant roof panel is designed for fast, economical rebuilding and conversion of industrial furnaces. Panels consist of radiant cup-type burners mounted in a one-piece refractory tile casting ready for immediate installation. The entire panel can be suspended by integral $\frac{5}{8}$-in. steel tie rods attached to the reinforced refractory cover plate. Final sealing is simplified by a $1\frac{1}{2}$-in. step on all sides. Companion arches are available for use with the radiant panels as front walls in slot-type furnaces or as curtain walls in continuous furnaces. Panels are said to be available for all existing aluminum melting furnaces.—**J. A. Kozma Co.**, 2471 Wyoming Ave., Dearborn, Mich.

For More Details Circle No. 481—Page 53

CLIPPING PRESS

Downstroking clipping press is available entirely self-contained or for use with a central drive unit. This special purpose semiautomatic press features fast approach and fast advance at full tonnage through the work. It offers a maximum pressure of 34 tons, with an easily set choice

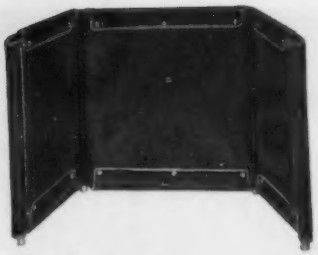


of 11 or 22 tons, through a 2:1 or 3:1 intensification of the 1000-psi feed supply.—**B.I.P. Engineering Ltd.**, Sutton Coldfield, England.

For More Details Circle No. 482—Page 53

PORTABLE SAFETY SHIELD

Portable safety shield is for welding, grinding, and other metal manufacturing operations. Curtain, made of heavy duty olive drab duck, is water and mildew resistant. Frame is constructed of heavy tubular steel, and steel connecting rods have rust-proof, black oxide finish. The rods are inserted into the open ends at the top and bottom of the tubular uprights and held in place by the curtain. No hooks, bolts, screws, or wires are used, and no tools are required to assemble or take apart the



shield.—**Special Products Div., Singer Glove Mfg. Co.**, 860 W. Weed St., Chicago 22, Ill.

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GOGGLE RESPIRATOR

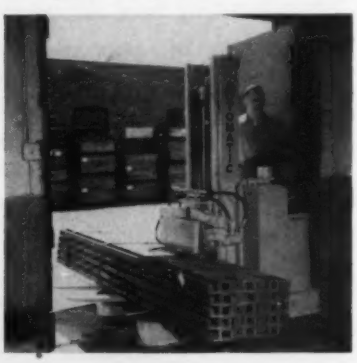
Drednaut goggle respirator is a one-piece, masklike combination molded from flexible rubber. It is lightweight and fits over all types of personal glasses. An internally molded ridge separates the goggle section from the respirator section. A double facial seal stops exhaled air from reaching the goggle section. The goggle contains an impact-resistant, 0.060-in. thick acetate lens.

The respirator section features a twin cartridge combination. Thirteen sets of cartridge and filters are available for protection. A basal drainage feature expels collected moisture.—**American Optical Co., Safety Products Div.**, Southbridge, Mass.

For More Details Circle No. 484—Page 53

LIFT TRUCK

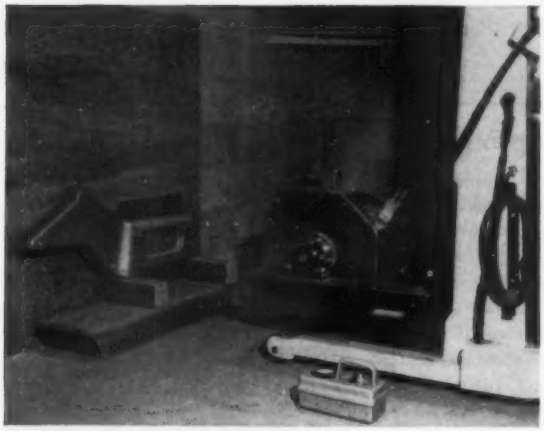
Transveyor Crab truck is designed for unusual material handling problems. Stereo-Matic steering permits traversing in any direction, at any angle, with load of any shape. This steering and the twin drive motors are operated by one control lever



which provides forward and reverse turning without use of the steering wheel. Angle and side steering are

Caterpillar D8 Tractor with ripper tearing through road material

Rippers really rough it – Radiography checks their stamina



Ripper Shank being radiographed with cobalt 60 projector

Ripper shanks and clevises at the business end of a high-powered tractor lead a torturous life as they tear through overburden and rock.

So Caterpillar makes sure of their stamina—has them x-rayed at the foundry that casts them. This is the place to show up imperfections—any voids—any inclusions. For here radiography can do two things. It can make sure only physically fit castings go out. It can point the way to improved casting technics resulting in better castings and greater yields.

Foundrymen everywhere—in small plants and large—find radiography a big factor in pleasing customers and building business. If you would like to know more about how it can help you, get in touch with an x-ray dealer or write for a Kodak technical representative to call.

Read what Kodak Industrial X-ray Film, Type AA, does for you:

- Speeds up radiographic examinations
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X-ray Division
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TRADE MARK

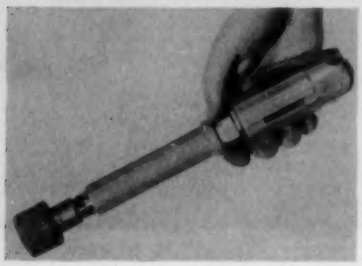
Circle 621 on Page 53

controlled by the wheel. Truck has 4000-lb capacity.—**Automatic Transportation Co.**, 149 W. 87th St., Chicago, Ill.

For More Details Circle No. 485—Page 53

PNEUMATIC TOOL

Model 2EL5 pneumatic tool is designed for hard-to-reach areas. The four-vane rotary air motor design is said to give positive starting, higher torque, and higher horsepower output. Tool weighs 2 lb and measures 13/16 in. from center line to

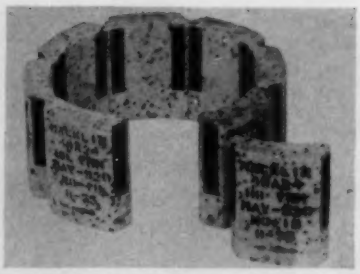


side, with an over-all length of 11 in. Collets take shanks from 1/8 to 3/8 in.—**Doeden Tool Corp.**, Sherwood, Ohio.

For More Details Circle No. 486—Page 53

PROCESS WHEELS

MM Process abrasive wheels and segmented wheels have been developed to increase production on the grinding of carbides, cast iron, and hard-to-grind steels. The process involves the uniform, loose dispersion of fine abrasive pellets throughout the matrix of the wheel. Pellets function as a cooling element and release a flow of loose abrasive between wheel and work. Pellet construction is designed to permit use of a harder, longer lasting wheel matrix.—**Macklin Co.**, Jackson, Mich.



For More Details Circle No. 487—Page 53

LIFT TRUCK

Designed for maximum maneuverability, the 3000-lb capacity Model FTB 30-24 has an outside turning radius of only 67 in. Its 4-cylinder, 133-cu-in. displacement, heavy-duty engine is available in either gasoline or LP fuel models and delivers 35 bhp at 2400 revolutions per minute.

Two transmissions are available, a standard two-speed, constant-mesh transmission and an optional Power-Shift Torque Converter Drive. Attachments include hydraulically operated side shifters and mechanical crane arms and rams.—**Allis-Chalmers Mfg. Co.**, Tractor Group, Milwaukee 1, Wis.

For More Details Circle No. 489—Page 53

ELECTRIC HOISTS

Balanced Design line includes wire-rope electric hoists with lifting capacities from 2000 lb to 50,000 lb, with lug, hook, plain, hand-geared, or motor-driven trolley mountings; with standard or low headroom arrangements; and base, wall, ceiling, and deck mountings. Powered trolleys are available with a variety of drives, including single-speed, two-speed, or variable-speed types.

Lifting speeds, according to model, range from a low of 10 to 20 fpm to a high range of 20 to 100 fpm. Height of lifts offered ranges from 15 to 100 ft.

The principal advantage claimed for the hoists is that each part of its motor, gearcase, drum assembly, and brakes has been matched against each other for strength, temperature, and performance characteristics.—**Harnischfeger Corp.**, Milwaukee 46, Wis.

For More Details Circle No. 490—Page 53

Conditioner Improves Green Sand Properties

● SAND BINDER 230 is a conditioning agent which is said to function efficiently at treatment levels of 1 to 16 oz per ton. A high molecular weight, water soluble polymer, it is reported to improve all green sand properties when used as recommended, with reductions in both sand and production costs.

This material is claimed to increase flowability of a typical sand from 75 to 85 or higher and mold hardness from 75 or 80 to 85 or higher.

In addition, permeability and green compressive strength are increased, and green deformation is more nearly uniform than usual. In some formulations, use of this additive in conjunction with tetrasodium pyrophosphate enhances its action on dry shear strength.

Binder 230 is described as not a cure-all for all sand problems, nor a replacement for good sand control. As in all good foundry practice, attention should be paid to sand size distribution, moisture temper, bentonite quality, and binder level. The requirement for pH control to prevent spoilage is eliminated, however. Continued use of this binder is stated to have a pronounced effect on the cleanup of sand grains in both wet and dry sand reclaiming.

Other advantages claimed include ease of handling and storage; clean pattern release and draw; slight gas evolution during pouring; good collapsibility and shakeout with less fine contamination and carbonaceous deposit; good sand peel; and over-all cost savings.—**Dow Chemical Co., Western Div.**, P. O. Box 351, Pittsburg, Calif.

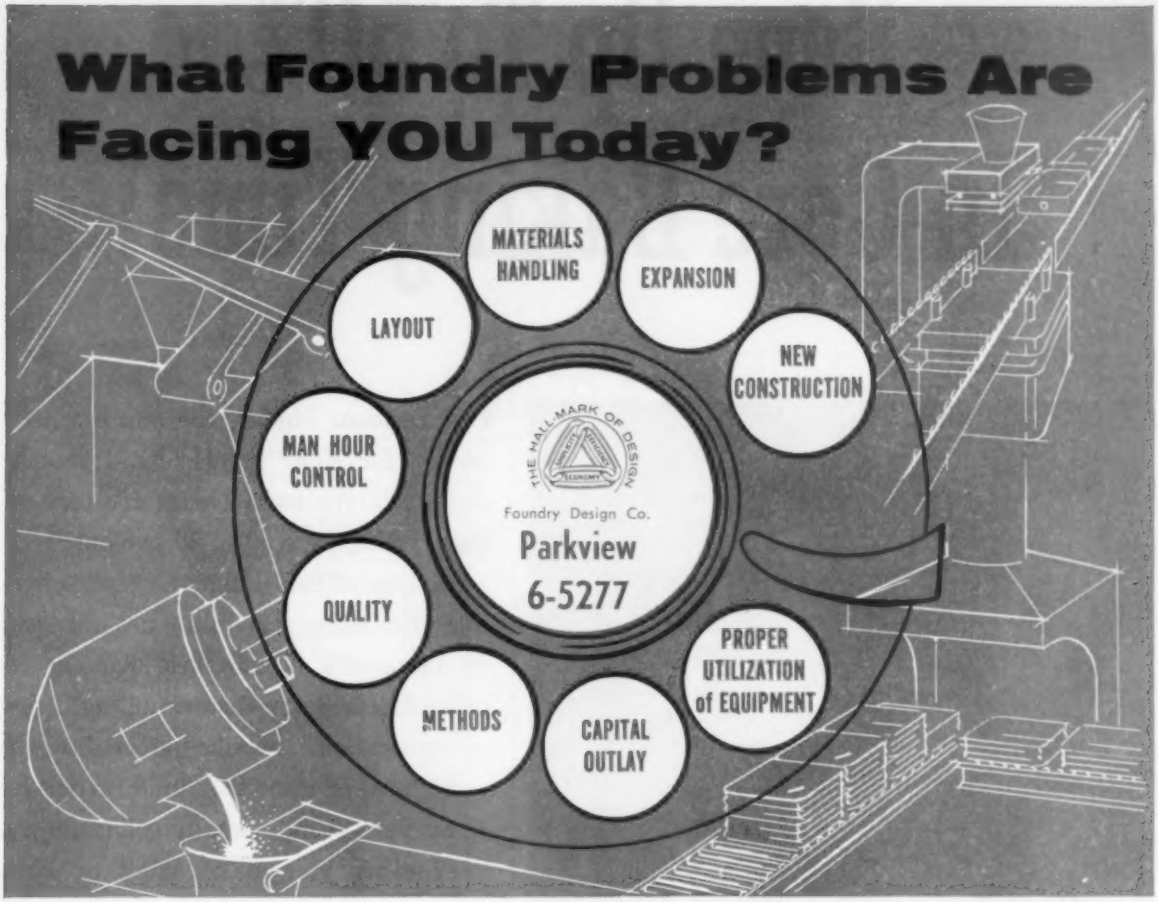
For More Details Circle No. 488—Page 53

BARREL FINISHING MEDIA

Honite barrel finishing media for zinc diecastings is said to produce a low microinch surface and to protect workpieces against surface impingement. Media feature rapid

cutting rate, fine-mesh abrasive, slough suspending chip action, light weight, and fracture resistance. Its shape is that of a truncated pyramid. —**Minnesota Mining & Manufacturing Co.**, 900 Bush Ave., St. Paul 6, Minn.

For More Details Circle No. 491—Page 53



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By contacting Foundry Design Co., you may bring into your plant immediately a foundry engineering service developed by experienced personnel who can offer design ingenuity for special purposes adaptable to your operations.

At all times the objective is to achieve maximum efficiency and coordination in melting—molding — coremaking — cleaning. With such coordination, foundry deficiencies are remedied and production increased. Complete foundry production layouts utilizing existing equipment or guiding alterations, expansion or selection of new equipment are fundamental functions of our service.

Let us arrange for you to visit any of the companies who have availed themselves of our service.

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AMERICAN FOUNDRY & MFG. CO.	St. Louis, Mo.
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ELECTRIC STEEL FOUNDRY CO.	Portland, Oregon
ELYRIA FOUNDRY DIVISION OF CHROMALLOY CORP.	Elyria, O.
LAKEY FOUNDRY CORP.	Muskegon, Mich.
LUDLOW VALVE MANUFACTURING CO., INC.	Troy, N. Y.
MACK TRUCKS, INC. ...(Steel Foundry),	New Brunswick, N. J.
OTIS ELEVATOR CO.	Yonkers, N. Y.
A. P. SMITH MANUFACTURING CO.	East Orange, N. J.
TOWER GROVE FOUNDRY	St. Louis, Mo.
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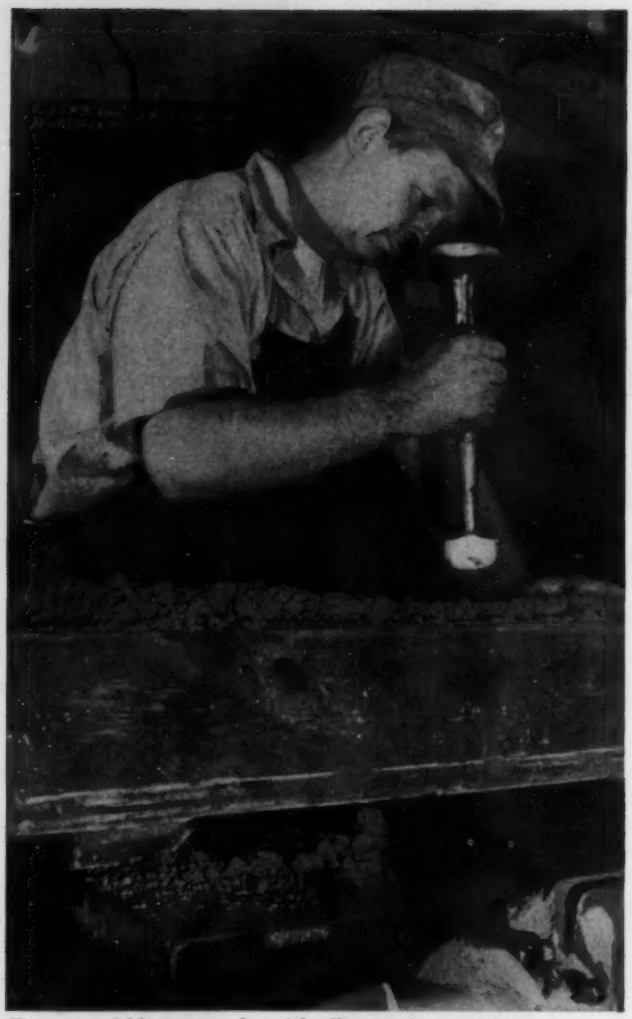
Circle 622 on Page 53

Save Up To 50% In Core Baking Time!



Dexocor yields top results with all ramming processes.

Use Dexocor binder, the amazing new binder for sand molds. Field reports show this *dry* replacement for core oil cuts baking time 30 to 50 percent!*

Savings of fuel dollars and more flexible production scheduling are only two of Dexocor's advantages. Among its other features are: faster mulling... low gas generation... excellent green strength ...high baked strength...uniform density ...easy shake-out...ready collapsibility.

Whether you make small or large castings, simple or intricate, you will profit by the properties of Dexocor. One foundry now uses it in 19 different sand and core mixes!

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The Outlook for
Copper and Aluminum Castings

Every man, woman, and child in the U. S. tends to use more aluminum castings and fewer brass and bronze castings as time progresses

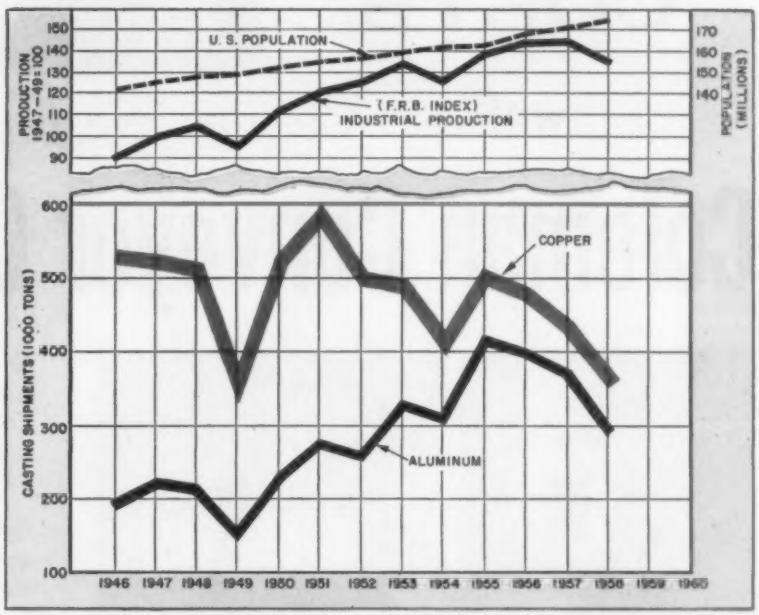
By A. R. BARBOUR
Vice President, Roessing Bronze Co.
Etna, Pa.

● A GREAT DEAL has been written about the rapidly growing population and economy of the United States. News reports tell constantly of new peaks of personal income, industrial production, and housing starts. The foundry industry in general and the nonferrous foundry industry in particular are not mentioned in these articles. We should ask, "What is our situation in this booming economy? Where do we stand?"

The population of the United States has been rising steadily, as indicated by the accompanying chart, and stands at about 178 million now. By 1965 it probably will reach 195 million. The lower part of this chart plots shipments of copper and copper-alloy castings since 1946 as a colored line and shipments of aluminum alloy castings as a black line.

Copper and copper-alloy casting shipments have declined since 1946. This rate of decline is even more rapid than the rate of increase in population. Aluminum and aluminum alloy casting shipments, on the other hand, are rising with the population and the economy in general. Copper-alloy castings are declining so sharply that they pull down the trend line even though it includes copper castings, which really are rising.

Per Capita Use—We can interpret these facts to mean that every man, woman, and child in this country tends to use more aluminum castings and fewer brass and bronze castings as time progresses. Brass and bronze therefore must be inferior or be too high priced per unit or have some other disadvantage that causes their use to decline while that of aluminum increases. Aluminum has not replaced brass and bronze as much as it has expanded in different fields. Brass and bronze have been replaced by stainless steel, plastics, and, to a lesser extent, by aluminum. The upper portion on this chart shows the Federal Reserve Board Index of Industrial Production. It shows a steadily rising trend since 1946.



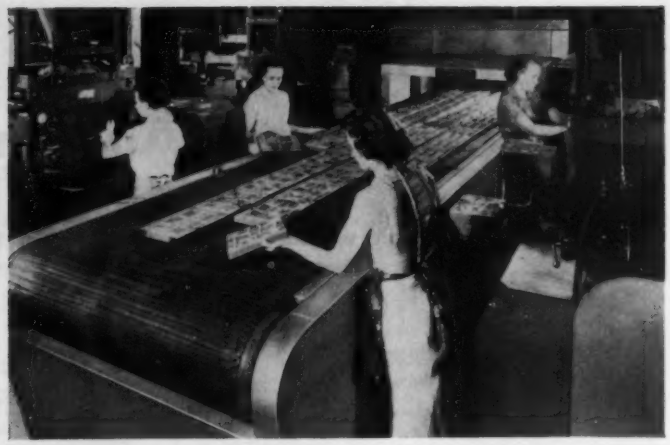
Upper part of chart plots U. S. population since 1946 as a broken line and FRB Index of Industrial Production as a solid line. Lower part of chart plots shipments of copper-base castings since 1946 as a colored line and shipments of aluminum castings as a black line

The important point to note first about brass and bronze casting shipments is that since the end of World War II, the trend has been almost continually downward. They show a pattern typical of a declining situation. Brass and bronze foundry shipments have continued to trend downward while both population and industrial production have been in strong, continuous uptrends.

Another important point involves consumption of copper and copper alloy wrought and cast plumbing fittings, which is rising. Unfortunately, no reliable data can be obtained on cast fittings only. I am of the opinion, however, after speaking to several manufacturers, that the volume of wrought fittings is relatively small compared with that of cast fittings. If we may accept this opinion as a fact, we may say that the production and consumption of copper-base castings for plumbing fittings has grown at least as fast as the population. Since castings for plumbing fittings were

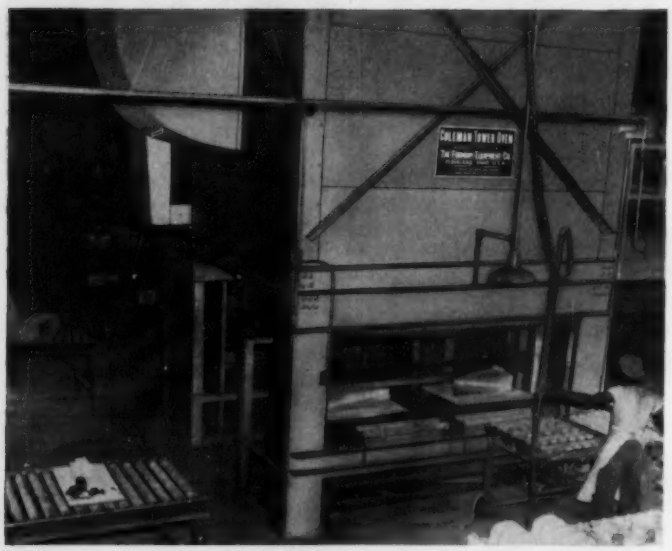
CUT LABOR COSTS

with



Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.

Coleman Conveyor Core Ovens



One of two large Coleman Tower® Core Ovens in a major steel foundry baking cores up to 150 pounds. Self-amortizing investment . . . ovens paid for themselves out of direct annual savings in less than two years.

● Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%.

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

WRITE FOR BULLETIN 54

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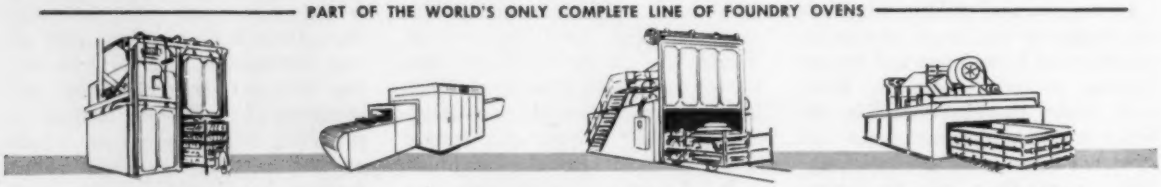

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OVENS and FURNACES for FERROUS and LIGHT METAL

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• Rack type ovens for aging (left) and solution heat treat (right) of aluminum alloy castings.

• Car type annealing furnace for steel castings, over-and-under-fired, features induced circulation of gases for temperature uniformity.

• Magnesium aircraft castings are solution heat treated in Coleman rack type SO_2 atmosphere ovens.

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Circle 625 on Page 53

included in brass and bronze foundry shipments on the chart, the rest of the brass and bronze foundry industry is in an even more steeply declining trend than indicated.

Problems—We now can deduce the following:

1. Aluminum casting shipments are growing more rapidly than either the population or the economy in general. This growth probably is due mainly to the excellent sales promotion work of the primary aluminum producers and does not represent solely an accomplishment of the aluminum foundries in general.

2. The brass plumbing fittings industry is growing as fast as the population and the economy in general. Its prosperity undoubtedly is due to the need for new housing. Thus the aluminum casting and brass plumbing fitting segments of the nonferrous foundry industry are prospering, but largely because of outside influences.

3. The brass and bronze foundry industry in general, with the exception of plumbing goods, is in a severe declining trend. A number of reasons can be given for this situation. One of the first that comes to mind is the replacement of bronze bearings by ball and roller bearings, although recent establishment of the Cast Bronze Bearing Institute may help to reverse this trend. Freight car journals which were 100 per cent babbitt-lined bronze 15 years ago now are either roller or steel-backed babbitt. A recent newcomer to the bearing field is nylon, and aluminum also is under examination for freight car journal boxes. Bronze is still superior to all other bearings in applications above 5000 rpm.

Plastics have displaced brass castings for ornamental hardware in furniture and for other household uses. Aluminum art castings have made great inroads into a business which at one time was exclusively bronze castings. Nodular iron has taken over many machinery applications that only brass and bronze formerly could do as well. Stainless steel valves and other cast fittings have completely replaced brass and bronze in food processing and canning as well as in bleaching and dyeing equipment, and stainless now is making great inroads in hospital equipment.

Solutions—What can be done about this situation?

In many of the instances just mentioned, a superior or more economical product replaced brass and bronze castings. This sort of loss is the result of progress. Unless we find new applications for brass and bronze castings, however, progress will drive us right out of business. The nylonmakers learned by research that their product could be used for bearings, but the foundry industry is lacking in this sort of research and development program. Certainly some type of research could be started to help this industry to rebuild lagging sales. Money should be available for a purpose so important to this industry.

A Helpful Project

One bright spot in the research picture is the work done at Battelle Memorial Institute, financed by the Brass and Bronze Ingot Institute, on the properties of certain bronze alloys at extremely cold temperatures. Engineers who design ballistic missiles and space satellites in which these very properties are needed, are unaware of the usefulness of bronze under these conditions. In addition to the research program, an effort must be made to teach design engineers about the good points of nonferrous castings.

The large aluminum producers have developed an excellent and extensive research program to develop new uses for aluminum and new and better alloys. The aluminum foundry industry has benefited greatly by the money spent in this way and actually has been relieved of the need to spend its own money for research. This situation does not exist in the case of brass and bronze. The large primary copper producers have spent, until recently, relatively small amounts of money to develop new applications and uses. This segment of the industry is fighting for survival and must take some action to get research going.

In my opinion, research to develop new applications for our products is far more important than any technical improvements that we can make at this time. For that matter, without new applications the whole foundry industry will wither on the vine.

Selling Is Weak—The entire in-

dustry is weak in its selling efforts. Many foundries do not have even one full-time salesman. I know of one shop which sells nearly $1 million worth of castings a year and has only one part-time salesman. These sales may seem good, but they have declined from $2 million a year. In other instances, foundries depend entirely on commission salesmen who also handle half a dozen other lines. Part-time selling will not develop a good sustained volume of sales.

In the captive foundries which serve giant corporations, salesmen are needed to contact the various plants of the parent company which consume castings. The function of these salesmen is to tell the management of the casting-consuming plants what the foundry can produce and at what price. Without this information, the product may be machined from bar stock or made by forging, although a casting would be cheaper and better.

These facts make it clear that the foundry that does not make a good sales effort today will not succeed tomorrow, whether it is a jobbing foundry, a specialty foundry making plumbing fittings, or a captive foundry. Many specific examples can be cited of brass and bronze foundries which have doubled their business in the last 5 years, even though the industry's volume has been declining. This kind of record always is due to a planned sales campaign and good salesmen.

Price Stability Required — Over and beyond these selling difficulties, brass and bronze castings have been at a great disadvantage pricewise, not because of relatively high prices, but because of a lack of stability in prices of raw materials. These raw materals amount to one-third to one-half of the total cost of producing a casting.

For example, 85-5-5-5 metal, which is the basic alloy to which all other alloys are related, in recent years varied in price from 12½ cents per pound to 22 cents per pound, fell back to 15 cents, rocketed to 44 cents in 1956, and then plummeted to 25 cents in 1958. Casting users who could get away from brass and bronze did so merely to avoid the inventory difficulties brought on by widely swinging prices.

The price situation has been caused by conditions in basic copper, where, if anything, the price swings have been even wider. The large virgin copper producers have learned, however, how these price changes hurt their sales as well as those of copper-base alloy castings, and they probably will try to stabilize market prices. Aluminum has been blessed with stable or, at worst, only slightly rising prices. The whole aluminum industry has used this fact as one of its most important selling points.

We can summarize by saying that the aluminum foundry industry is in an enviable situation. Its sales are rising, and the primary producers are finding new applications. The future in this casting field looks rosy as long as a reasonably good sales effort is made.

On the other hand, sales volume of the brass and bronze foundry industry is decreasing. This segment of the industry must find through research new applications for its products, improve its quality, sta-

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	Feeding Range	Heat Transfer
	Surface Tension	Temperature Gradients
MOLDING	Sand Characteristics	Permeability
	Clay Minerology	Thermal Conductivity
	Solidification Rates	Compaction
	Colloidal Chemistry	Flowability
	Adhesion and Cohesion	Heat Extraction
MELTING	Combustion	Reaction Rates
	Thermodynamics	Equilibrium Constants
	High Temperature Laws	Free Energy Equations
	Heat Balances	Solubility Principles

As you know, well trained foundry engineering talent is in short supply. Where are you going to get these men when you need them? The answer is this: You can help create a pool of foundry engineering talent by participating in the F.E.F.'s educational program. Write today for our booklet, "Let's Look Ahead."

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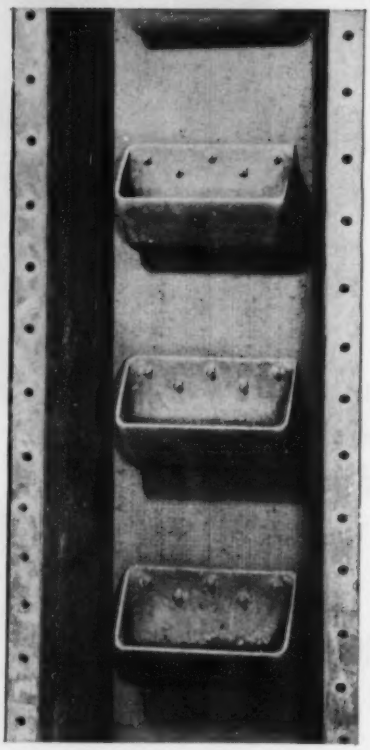
Imperial Belting makes another tough job easy

When the OPW Corporation of Cincinnati installed their foundry sand handling system in 1952 they came right to Imperial for the elevator belting it required.

The Imperial patented INNER-LOCKED* Belting we supplied has given outstanding performance in a tough foundry operation involving continual abrasion, constant stress, and periodic choke-ups. But, let the folks from OPW tell you about it . . .

"The original Imperial Sahara* Belt is still in good condition and appears to have considerable more life left in it. However, it is our policy to replace certain types of equipment before they wear out. A second belt we've ordered will be installed this year, at which time the original belt it replaces will have given us seven years of trouble-free service."



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bilize its prices, and at the same time redouble its sales effort.

This article has been condensed slightly from a paper presented at the Penn State Foundry Conference on June 25, 1959.

Northwest Regional Conference Will Be in Seattle, Oct. 2-3

Washington Chapter, AFS, is host for the 10th annual Northwest Regional Conference in Seattle, Oct. 2-3. William K. Gibb, Atlas Foundry & Machine Co., Tacoma, Wash., is conference chairman, and Harold R. Wolfer, Pudget Sound Naval Shipyard, Bremerton, Wash., is program chairman.

Program details follow:

Friday, Oct. 2

Morning Session: "Hydraulics for the Practical Foundryman," Prof. William M. Miller, University of Washington, Seattle; "Pattern Rigging," Edward B. Rommen, Puget Sound Naval Shipyard, Bremerton, Wash.; and "Nondestructive Testing," Solomon Goldspiel, U. S. Naval Shipyard, Brooklyn, N. Y.

Luncheon: "What About the Future?" Frank G. Steinebach, editor, FOUNDRY.

Afternoon Session: "Production Techniques for Ductile Iron and Problems of the New Producer," David Matter, Ohio Ferro-Alloys Corp., Canton, Ohio; "New Foundry Developments," Fred Wiehl, Federated Metals Div., American Smelting & Refining Co., Los Angeles; "West Coast Foundry Sands," Frank S. Brewster, Brumley-Donaldson Co., Huntington Park, Calif.; and "High-Strength Aluminum Alloys," Alan De Ross, Kaiser Aluminum & Chemical Sales Inc., Chicago.

Saturday, Oct. 3

Morning Session: "New Core Practices," Richard Grogan, Archer-Daniels-Midland Co., Los Angeles; "Core Binders," John Bermingham, E. F. Houghton & Co., San Francisco; "Sand Practices at Electric Steel Foundry Co.," Anthony A. Belusko, Electric Steel Foundry Co., Portland, Oreg.; and "Factors Affecting the Performance of Mold and Core Sand," E. A. Lange, Naval Research Laboratory, Washington.

Afternoon Session: "Steel Melting," Lovick Young, A-1 Steel Foundry Ltd., Vancouver, Canada; and "Induction Melting of Steels," Leroy Fink, Electric Steel Foundry Co.

AFS Chapters Plan East Coast Regional

The East Coast Regional Conference, sponsored by the AFS Metropolitan, Philadelphia, and Chesapeake Chapters, will be held Nov. 20-21, at the Statler-Hilton Hotel, New York.

Fred G. Sefing, International Nickel Co., New York, is general chairman of the conference, and Henry Winte, Florence Pipe & Machine Co., Florence, N. J., is program chairman and head of the gray and ductile iron sessions.

Other division chairmen include William H. Baer, Army Engineers, Fort Belvoir, Va., brass, bronze, and aluminum; and F. B. Herlihy, American Brake Shoe Co., Mahwah, N. J., steel.

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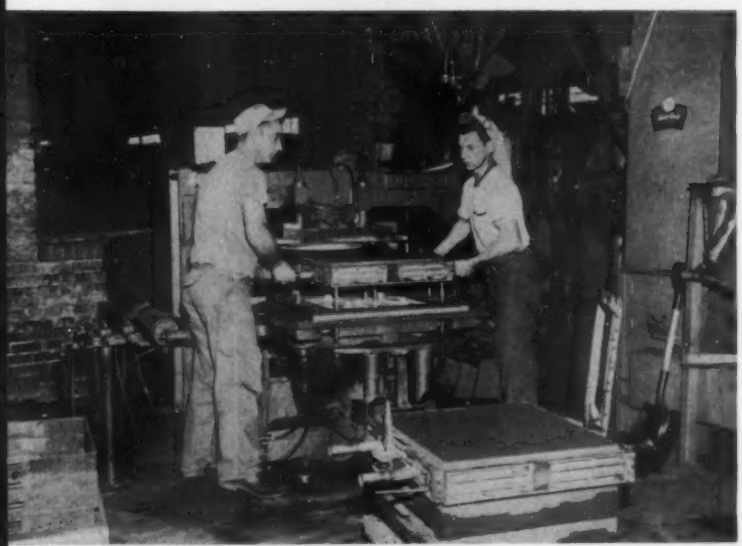
Circle 629 on Page 53→

ANOTHER

NEW INTERNATIONAL

SK20

Jolt-Squeeze-Drop Strip or Pin Push Up *or* Drop Strip Roll On - Roll Off



Here is a new machine, designed for larger requirements, incorporating sound engineering features, that can be made with

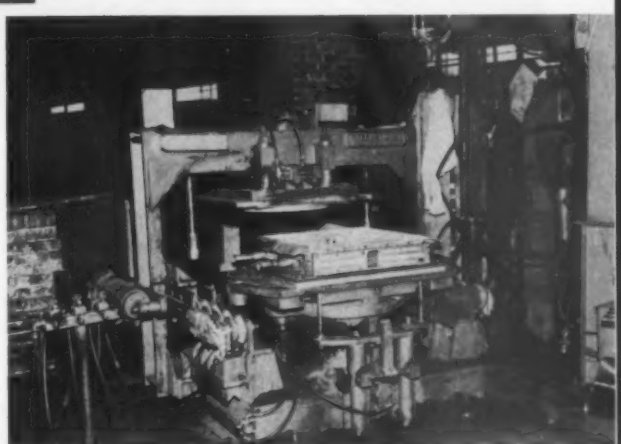
any size jolt
any size squeeze
any size draw
for any size job.

The SK20 illustrated has 20″ squeeze cylinders, an 8″ jolt cylinder, and is designed as a multiple molding machine—with a 4″ draw. Picture shows hand control valves. It can also be furnished with partial or completely automatic control cycle.

Photos Courtesy of
PHILCO CORPORATION - Dexter Foundry Division - Fairfield, Iowa

Operational Features of the SK20

- ★ Head moves out – away from table of machine for easy loading of sand and flask.
- ★ Head moves in – Large V guides insure proper alignment of head over table for accurate and square, uniform squeeze – and true draw.
- ★ Two large cylinders control the movement of the head with oversized deceleration valves for cushioning.
- ★ Can be loaded from front – side – or rear.



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"Brown Hot Blast . . . a Valuable Tool in the Production of Quality Castings"

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"Brown Hot Blast has definitely improved the quality of our castings. The cupola combustion temperatures are naturally much higher, reducing the possibility of defective castings, resulting in greater ability to convey metal long distances, and more latitude in making alloy additions and ladle transfers.

The process allows us to obtain uniformity in chemical analysis and the metal has less tendency to chill in thin sections. Hot Blast reduces the pounds of coke required, resulting in a lower sulphur pickup of the metal charge. Less desulphurizing materials are required and pig iron with a lower manganese content can be used.

Brown Hot Blast is a valuable tool in producing uniform quality castings, free from hidden defects."

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The Dalton Foundries, Inc.
Warsaw, Indiana

The Cincinnati Milling Machine Co.
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Industry Briefs

Ajax Magnethermic Corp., Youngstown, Ohio, has formed a Canadian subsidiary, Ajax Magnethermic Canada Ltd., Ajax, Ontario. The company will market the products of the three divisions of the U. S. parent company in Canada.

Dow Chemical Co., Midland, Mich., has formed a new division, Dow Metal Products Co., for the fabrication and semifabrication of magnesium, aluminum, and other metals. It will replace the Dow Magnesium Products Dept. Major manufacturing facility of the new division is the sheet and extrusion plant at Madison, Ill. At Bay City, Mich., the company has extensive casting facilities and a plant for the production of fabricated assemblies.

Ohio Brass Co., Mansfield, Ohio, and Allis-Chalmers Mfg. Co., Milwaukee, have formed a new corporation, OBAC Inc., to acquire and expand facilities for manufacture of power factor capacitors for utility and industrial applications. The new concern is in Mansfield.

Alloy Casting Institute has moved its headquarters from Mineola, N. Y., to 1001 Franklin Ave., Garden City, N. Y. Telephone number remains PIoneer 6-3970.

Hevi-Duty Electric Co., division of Basic Products Corp., Milwaukee, has purchased Sermax Corp., Milwaukee. Sermax has been a manufacturer of ovens and special equipment for 14 years.

Magnet Cove Barium Corp., Houston, has completed a new sales office and foundry research building at Rolling Meadows, Ill. The building is headquarters for the company's Foundry Div., which formerly was located at Des Plaines, Ill.

Metalmasters Inc. has moved to a new and larger plant at 5725 Ravenswood Ave., Chicago 26, Ill.

Hydra-Blast Mfg. Div., Automation Services Inc., Detroit, has appointed Waldron Co., North Haven, Conn., and General Supply & Equipment Co., 15583 Brookpark Rd., Cleveland 11, Ohio, to be distributors for its products.

Reichhold Chemicals Inc., White Plains, N. Y., intends to purchase Varcum Chemical Corp., Niagara Falls, N. Y. Varcum Chemical will operate as a division of RCI. It produces industrial resins.

Tucson Iron Works, Tucson, Ariz., has been sold for more than $250,000 to a group of local business men headed by Lamar Cotten. The new owners plan expansion of the property.

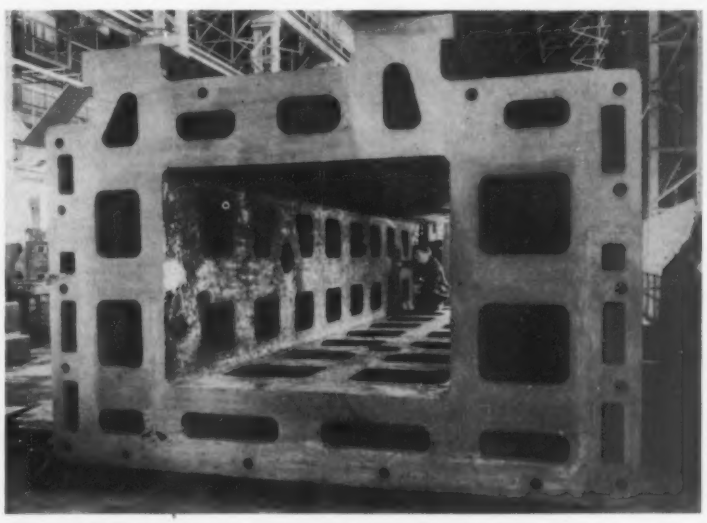
E. A. Wilcox Co., San Francisco, with branch offices and warehouses in Los Angeles and Seattle, has been appointed west coast distributors for Ramtite Co., Chicago.

Standard Refractories Ltd., Hamilton, Ontario, has been formed by Fred Rutherford, John Storer-Folt, and Miss N. Kerr. This company represents a complete range of refractory products, manufacturing facilities, and engineered installations.

Egloff & Graper Inc., 1798 Industrial Way, Los Angeles, has been formed by Edward Egloff and Robert E. Graper. The new firm will handle Southern California representation of Lanly Co., Cleveland, and West Coast representation of Electro-Alloys Div., American Brake Shoe Co., Elyria, Ohio.

Dalton Foundries Inc., Warsaw, Ind., has acquired Endicott Church Furniture Co., Warsaw, as a part of an expansion program. The company also plans to expand present gray iron facilities and to enter the aluminum permanent mold castings field.

Neenah Foundry Co., Neenah, Wis., has begun construction of an automated foundry that will double the company's casting capacity. The new 48,000-sq ft facility will produce heavy castings and will be situated on a 25-acre site on the south



CAST COLUMN: Rigidity and ruggedness are essential in large machine tools. This cast column is for a 10-in. spindle, ram type, horizontal milling and boring machine, a product of Asquith Machine Tool Corp. Ltd., Halifax, England. Photo courtesy British Information Services

International MINERALS CHEMICALS

A REPORT TO FOUNDRIES

FROM TOM BARLOW

Taccone Diaphragm Molding tightens the squeeze on casting costs

You may not really care that Taccone has once more designed and built "the world's largest," shown below. The chances of your needing a duplicate of this new mammoth are indeed slim, but — this modern molding miracle *does* illustrate Taccone's ability to design to fit your problem. For example, this particular machine illustrated will bring into a foundry work that has been in weldment for many years.

Because there is no apparent limit to the size and type of machine which can be handled by the Taccone Diaphragm design, many savings are possible. For example, maintenance and downtime are a function of machine speed. Taccone builds fast machines, but also designs to fit multiple patterns to make many castings per mold — and therefore, per hour — even at slow, trouble-free speeds.

Diaphragm molding with this machine is complete, simple and reproducible. All variations of jolting, peening, ramming and tucking are eliminated. Mold hardness is consistent throughout the mold, and from one mold to the next. It's simple to operate, maintain, regulate and supervise. In fact, all procedures may be preset by the supervisor to eliminate possibilities of human error.

Why fit your job to a limited machine? Let us design this machine to fit your work — and increase your profits. It offers a list of advantages as long as your arm. We have literature that explains them all — why not write?

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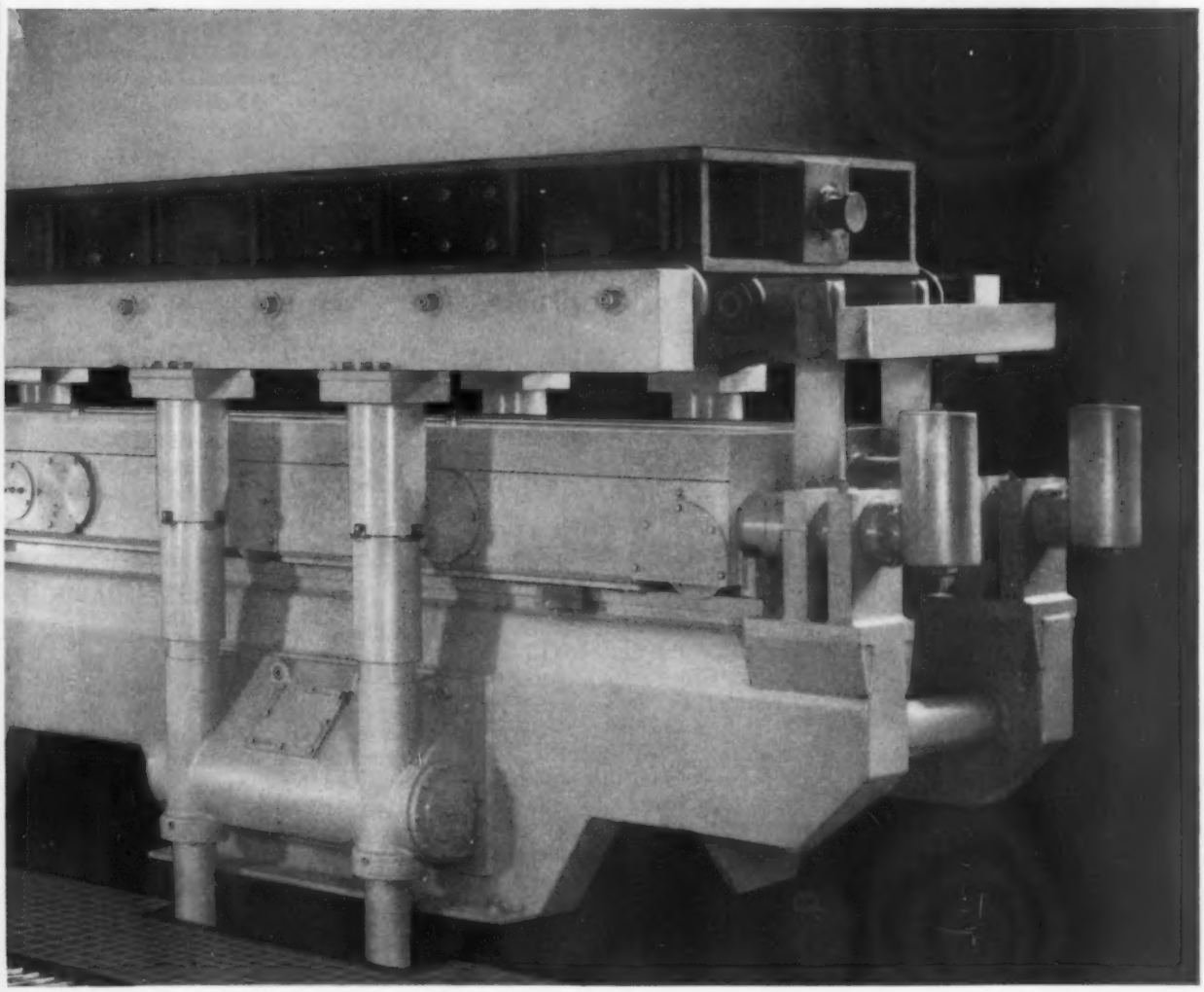


Circle 631 on Page 53

side of Neenah. Capacity will be 250 tons daily. Equipment will include fully automated molding equipment and 85-in cupolas.

Metal Treating Institute reports billings by its members during June of $3,518,500 or 48.6 per cent more than for June, 1958.

Magnesium Alloy Products Co., Compton, Calif., has acquired a license from Magnesium Elektron Ltd., Manchester England. The license grants Magnesium Alloy Products the right to manufacture, use, or sell in the U.S.A. castings produced pursuant to MEL's techniques, inventions, and patents.

Allis-Chalmers Mfg. Co., Milwaukee, has acquired Lakefield Mfg. Co., Wauwatosa, Wis. Kenneth J. Quaiman, previously plant manager, has been named works manager of the newly acquired facilities, which will be operated as the Wauwatosa Works, in conjunction with the company's Deerfield, Ill., Works.

Advance Aluminum Castings Corp., Chicago, has purchased Ross Mfg. Co., Chicago. The combined company will be called Advance Ross Electronics Corp. and will continue the operations of Ross Mfg. Co., manufacturer of television components.

Electronics Div., Gorham Mfg. Co., Providence, R. I., has added a new investment casting facility as part of its current expansion program. The foundry will enable the division to produce its own castings for microwave antennas and components in aluminum, magnesium, and copper alloys.

Detroit Harvester Co., Oak Park, Mich., has changed its name to Dura Corp. Its divisions include Dura Div., Toledo, Ohio, which manufactures industrial diecastings, and Paragon Aluminum Corp., Monroe, Mich., producer of permanent mold aluminum castings.

Duplicast Corp., Detroit, has become a Shaw licensee and has begun production of precision cast tooling and prototypes in ferrous, nonferrous, and high-temperature alloys. This company will melt a wide range of alloys, serving various phases of the tooling industry.

Lester B. Knight & Associates Inc., Chicago, has moved its New York offices to Suite 838-841, 500 Fifth Ave., New York 36.

Hawaii Beckons Operator of

"HANDLEBAR HARRY"

● "HANDLEBAR HARRY, the oldest Simpson Mix-Muller this side of the cupola," is being sought by its manufacturer, National Engineering Co., Chicago.

After a four-month "teaser" campaign of advertisements in foundry business publications, National has revealed plans to conduct an industry-wide contest intended to locate the oldest Mix-Muller still in foundry operation.

According to B. L. Simpson, National president, first prize will be an all-expense trip to Hawaii for two, via American Airlines and Pan American jets. Other prizes include color and black and white TV sets, shotguns and fishing gear.

All Users Eligible—The contest is open to anyone working in and for a foundry, and it was emphasized that any Mix-Muller, new or old, is eligible for a prize, based on a 50-word statement by the entrant.

Purpose of the contest is to introduce the "Mix-Muller Retirement Plan"—a trade-in program for used Simpson Mixers—and "to dramatize the important performance characteristics of the F-Series Mix-Muller."

Judges for the contest will be appointed by officers of the American Foundrymen's Society. Contest closes on Feb. 28, and winners will be announced at the AFS Convention in Philadelphia in May.

According to company spokesmen, the earliest Simpson Mix-Muller was manufactured in 1916. They did not reveal whether present location of the oldest mixer is known, but said that fairly complete records of all company machines ever built are maintained.

Further details and entry blanks may be obtained by writing Handlebar Harry, Machinery Hall, Chicago 6, Ill.

Material Handling Training Center Is Planned by MHEDA

Material Handling Equipment Distributors Association plans to start a Material Handling Training Center for equipment users and other interested parties. An option to purchase has been taken on the Post estate, Newport, R. I.

Harry Freeman, president, Freeman Industrial Service Inc., Providence, R. I., and chairman, MHEDA Engineered Equipment Committee, will be head of the center. Courses will be concentrated around live material handling equipment with seminar sessions.

re: coating your own sand

ARE YOU PAYING FOR EQUIPMENT YOU DON'T HAVE?

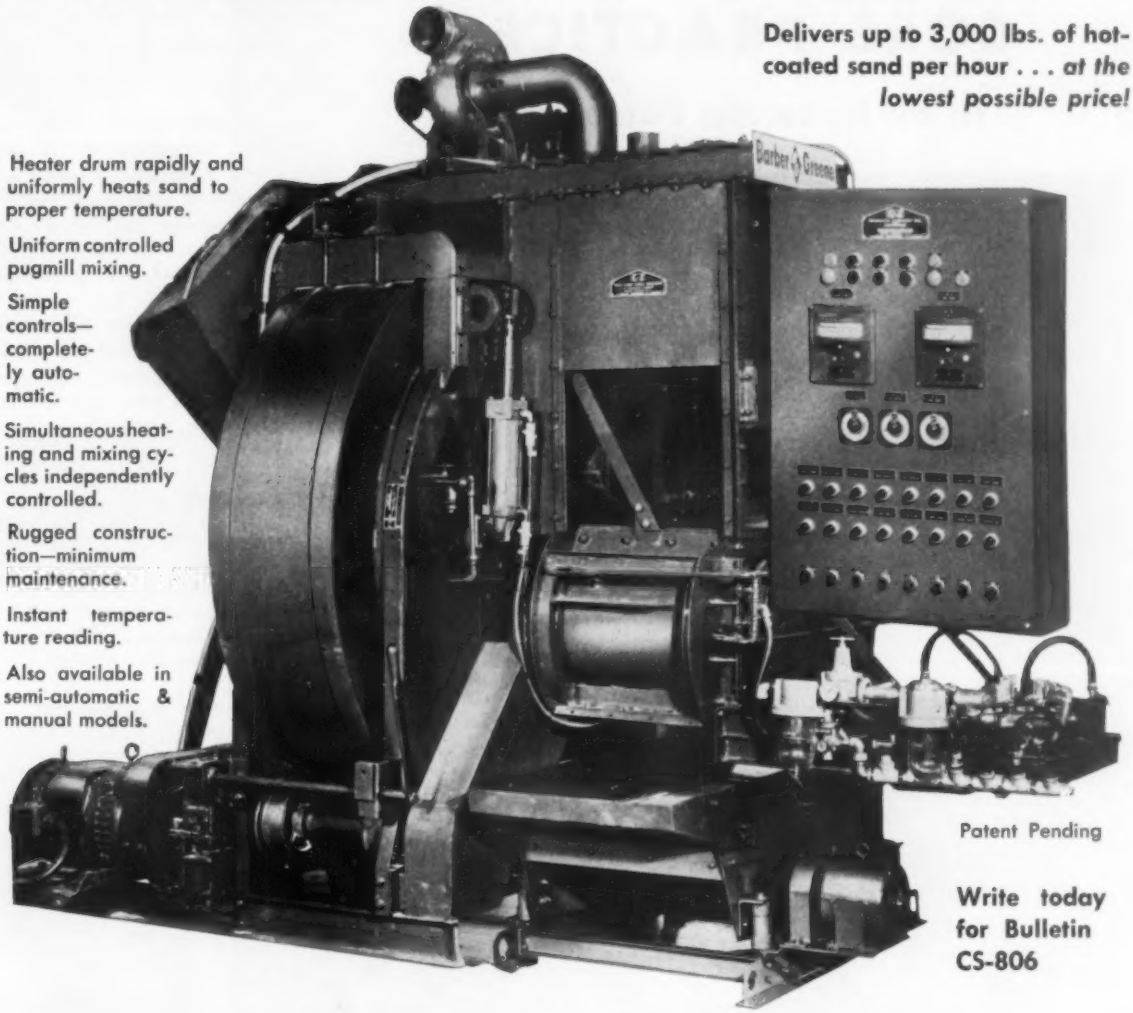
Old Equipment can be costing you more than enough to own the

Automatic "MIXALL" SHELL-SAND COATING UNIT

SAND (WET OR DRY) + **HEAT** + **RESIN** (LIQUID OR LUMP) —"HEXA"→ **COATED SAND** (FREE FLOWING — LUMP FREE)

Delivers up to 3,000 lbs. of hot-coated sand per hour . . . *at the lowest possible price!*

- Heater drum rapidly and uniformly heats sand to proper temperature.
- Uniform controlled pugmill mixing.
- Simple controls—completely automatic.
- Simultaneous heating and mixing cycles independently controlled.
- Rugged construction—minimum maintenance.
- Instant temperature reading.
- Also available in semi-automatic & manual models.



Patent Pending

Write today for Bulletin CS-806

Constant Quality Through Constant Control

C&S PRODUCTS CO., INC.

18656 FITZPATRICK
DETROIT 28, MICHIGAN

Affiliated with Barber-Greene

Core for gray iron connecting T is 9 in. long, weighs 6.8 lb

Grain Distribution of the Silica Sand (Natanya, Israel)

Sieve Mesh	Wt. on Each Sieve	Per Cent Fineness	Multiplier	Product
6	0.00	0.00	3	0.00
12	0.00	0.00	5	0.00
20	0.00	0.00	10	0.00
30	0.00	0.00	20	0.00
40	0.00	0.00	30	0.00
50	0.37	0.74	40	29.60
70	5.82	11.64	50	582.00
100	37.73	75.46	70	5282.20
140	6.12	12.24	100	1224.00
200	0.22	0.44	140	61.60
270	0.02	0.04	200	8.00
Pan	0.03	0.06	300	18.00
	50.31	100.62		7205.40

Grain fineness number: 7205.40/100.62=72

CORE PRACTICE

In an Israelian Foundry

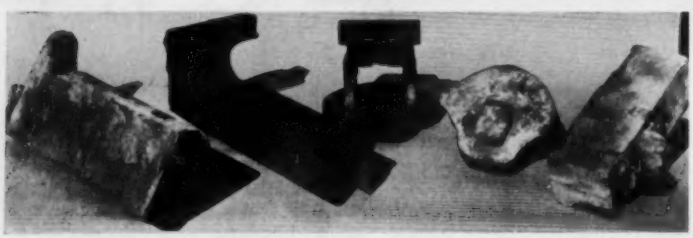
By JOSHUA PELLEG
Urdan Metallurgical Works
Natanya, Israel

● OUR FOUNDRY — the only one of its kind in the Middle East—produces blackheart malleable pipe fittings and other jobbing castings. Until two years ago, we used a resin type core mix composed of powdered urea formaldehyde resin with some hardener plus small percentages of cereal binder. We also added kerosine to overcome stickiness. The cores are baked in a dielectric core oven.

Due to the shortage of raw materials, we were forced to develop a suitable replacement. These efforts provided a new core mix that has met with unqualified success and also has led to material savings in foreign currency.

Liquid Resin Used—The base of

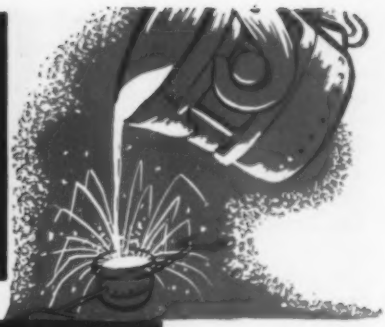
Dielectric core oven bakes 500 lb of cores per hr at 2 to 2.5 per cent moisture, 400 lb at 3 to 3.5 per cent moisture



Castings (second and third from left) and cores for 6-in. vise

Miscellaneous malleable iron pipe fittings. Cores also are shown

For Longer Lining Life Use . . .
WALSH Missouri-Quality REFRACTORIES for the FOUNDRY INDUSTRY



FIRE BRICK

Brand	Type	Fusion Point	Uses
WARCO XXT (Missouri High Heat Duty)	Dealred Stiff Mud	Cone 32-32½ (3137° F.)	An extremely dense, hard product for lining metallurgical furnaces where slag and abrasive action is severe. Such as cupola linings malleable furnace side walls and ladle linings.
BUNG BRICK (Missouri Super Duty)	Dry Press	Cone 33-34 (3200° F.)	Malleable furnace roofs.
MULLITEX (Missouri Super Duty)	Dry Press	Cone 33-34 (3200° F.)	Furnaces operating at high temperatures with sudden temperature changes. Malleable furnace bottoms and roofs, non-ferrous furnace lining, aluminum remelting furnaces, sidewalls and crowns.
MULLITEX HB (Missouri High Burn Super Duty)	Dry Press	Cone 33-34 (3200° F.)	Highly resistant to slag and sudden temperature changes. Hearths of aluminum remelt furnaces. Desulphurizing ladle linings—cupola walls.
WARCO D (Intermediate Duty)	Dealred Stiff Mud	Cone 30-31 (3000° F.)	Grey iron and electric furnace steel ladle linings, patching brick, runners, spouts.

Walsh also makes: Cupola Blocks, Tap Out Brick, Slag Hole Block, Ladle Bottoms, High Temperature Ferrous and Non-Ferrous Furnace Linings.

PLASTICS

Brand	Max. Service Temp.	Fusion Point	Packaging	Type	Uses
GRAFLOK (Missouri Super Duty Graphitized Plastic) (Wet or Dry)	3000° F.	Cone 33-34	100 lb. cartons 100 lb. bags	Heat Setting	For lining bull ladles, spouts, runners, cupola wells, and front slagging spouts.
K-11 PLASTIC (Wet or Dry)	3200° F.	Cone 36-37	140 lb. drums 400 lb. drums	Air & Heat Setting	Rammed linings in fluxing ladles, burner ports, and blocks, electric furnace linings, brass melting furnace linings.
BB 161 PLASTIC (Wet or Dry)	3200° F.	Cone 33-34	100 lb. cartons	Air & Heat Setting	For lining foundry holding ladles, bull ladles, spouts, runners.

CEMENTS

Brand	Max. Service Temp.	Fusion Point	Packaging	Type	Uses
MORT AIRSET (Wet or Dry)	3000° F.	3100 deg.F.	100 lb. bags 200 lb. drums 500 lb. drums	Air & Heat Setting	For laying up fire brick subjected to severe joint erosion, patching, wash coating.
METALOK (Missouri Super Quality Mortar—Dry)	3200° F.	3000 deg.F.	100 lb. bags	Heat Setting	Unusually resistant to slag action—highly suitable for laying up fire brick in malleable furnace sidewalls, ladles, hot metal mixers, electric furnaces.

Walsh also supplies the Foundry Industry with ground fire clays and fire brick, gun mix, super duty plastic fire brick, and castables, graphitized clay coatings and other refractory specialties.

WALSH REFRACTORIES CORPORATION

101 FERRY STREET, ST. LOUIS 7, MISSOURI

FACTORIES: ST. LOUIS AND VANDALIA, MISSOURI

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the mix is urea resin, but instead of the previously used powdered material, it is a liquid type containing 65 per cent solids. The pH is slightly on the alkaline side and the catalyst is boric acid. The other ingredient, which gives the final character for the core, is gelatine. The amount of gelatine varies according to the size of the core, its dimensions, and the baked strength demanded. The gelatine must be added very carefully and its ratio to the mix controlled. Otherwise we get a very strong core which causes hot tears in the casting.

The gelatine must be prepared at least 15-30 minutes before being used. Although it is possible to dissolve it in cold water, it is preferable to cover it with hot water to give a more effective dispersion of the gelatine in the shortest possible time. A minimum of water should be used. A ratio of 130-140 grams gelatine to 100 cc water is recommended. Since the resulting solution is a colloidal solution and not a true one, the pail or vessel must be cleaned after use.

A good and rapid dispersion of the gelatine is obtained if it is finely ground to approximately 40-60 mesh. Balls due to highly concentrated gelatine in water can be avoided by good mixing and allowing enough time for the maximum dispersion.

A 200-kg capacity sand mixer is used in the plant. The sand is of the subangular type, containing 96-98 per cent silica. Its grain fineness number is about 72. Grain distribution of the sand is given in the accompanying table.

Clay Kept Low—A clay-free sand gives the best results, so clay content must be kept as low as possible. From 1 to 2.5 per cent urea resin is added together with the hardener and mixed for 1½ min. Then 0.5 to 3.5 per cent gelatine is added and mixed for about 1 min. Kerosine is added as the last ingredient. The order of adding the materials is very important. Experiments showed that any change in that order may result in a core of reduced quality.

The moisture of the core must be kept under control and is an important factor, especially in a country with a climate such as in Israel. The moisture is 3.5 to 4.5 per cent. In case of overmixing, the workability (stripping) of the core mix is quite poor and baking difficulties also arise. This situation can be recognized by a sticky, plastic, and dense core mix. Total mixing time must not be more than 3-4 min.

To give the cores a high surface hardness, they are sprayed with water before entering the oven. Uniform baking provided by the dielectric oven eliminates problems connected with moisture. In the case of high moisture content, the speed of the rotating table is slowed down, resulting in a good hard core. In fact, we formerly worked without spraying, using a higher water content—up to 5-5.5 per cent. Choice of using a high moisture and slow baking time or low moisture and spraying should be based on the surface hardness needed for specific jobs.

In using conventional type core ovens, problems can arise if there is no uniformity during baking. These factors must be considered:

oh! IT'S SO SMOOTH AND SO LONG LASTING!

the new, all new NYLON NOTAT TIRE!

For a s-m-o-o-t-h ride, specify this improved NOTAT premium tire; softer rubber with Nylon assures easier riding, easier steering, no downtime, more traction and NO FLATS WITH NOTAT.

NO TUBE AIR TROUBLE

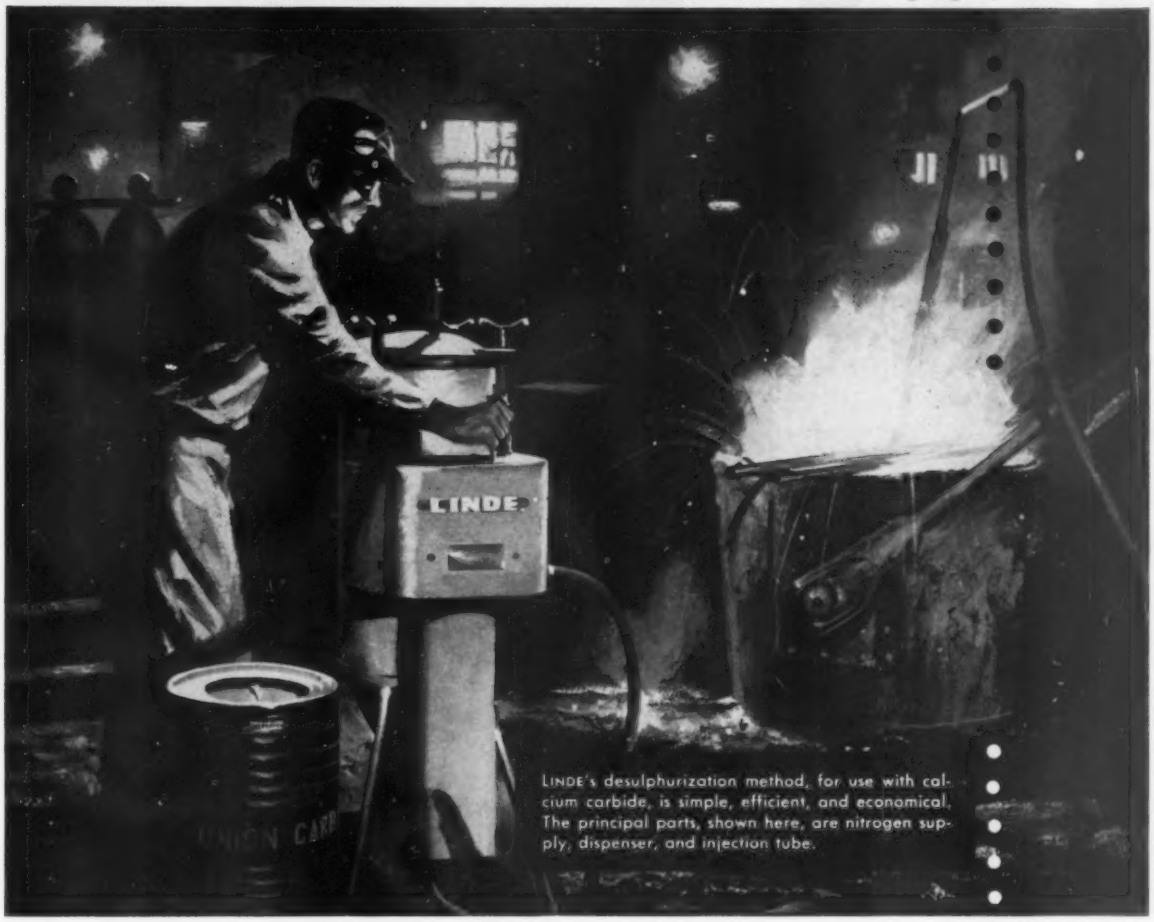
PATENT PENDING

NOTAT TIRE COMPANY

"WRITE TODAY FOR THIS OUTSTANDING INDUSTRIAL PNEUMATIC TIRE REPLACEMENT."

1504 East 34th St. Chattanooga, Tennessee

DESULPHURIZATION...



LINDE's desulphurization method, for use with calcium carbide, is simple, efficient, and economical. The principal parts, shown here, are nitrogen supply, dispenser, and injection tube.

You get uniform results with Metallurgical Carbide from LINDE

In the foundry, you can produce high grade iron only by making sure you use metal with a low sulphur content. As a desulphurizing agent, metallurgical calcium carbide assures *uniformity* in the metal you produce. You know in advance that by adding a certain amount of carbide you remove a certain percentage of sulphur. Because metal specifications can be met efficiently and economically with carbide, you eliminate any need for wasteful "trial and error" methods.

Linde's method of mixing UNION calcium carbide and molten iron is simple and sure. A stream of fine mesh carbide and nitrogen under pressure is forced from a dispenser through a hose. The graphite injection tube is immersed deep in the hot metal. The carbide blends evenly and thoroughly with the iron. Desulphurization with UNION calcium carbide creates no fumes, does not attack refractories. The LINDE equipment—nitrogen supply, dispenser, and injection tube—is easy to operate and maintain.

If you would like more information about LINDE's method of desulphurization, using calcium carbide, just call or write your nearest LINDE office. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Linde
TRADE-MARK

UNION CARBIDE

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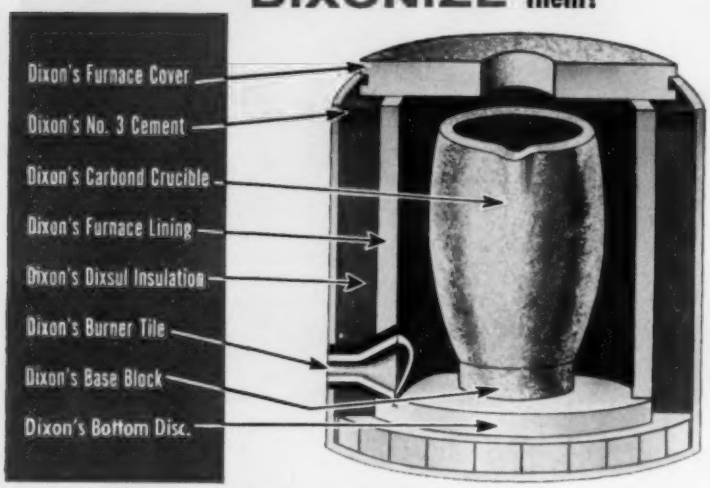
Circle 635 on Page 53

BEST By TEST

When maximum tonnage at lowest cost is a "must"... there is NO SUBSTITUTE for CRUCIBLE MELTING!

Here's how to get the MOST from YOUR crucible furnaces:

DIXONIZE them!



to economize

DIXONIZE

- **OVER 130 YEARS** of manufacturing experience combined with continuous research and field testing stands behind **every** Dixon refractory product . . . your guarantee of maximum performance at lowest cost.
- **Experienced Dixon Field Engineers,** located in every part of the United States & Canada (plus agents throughout the world) are prepared to help you obtain maximum operating economy through Dixonizing.

TON for ton — QUALITY for quality — CRUCIBLE MELTING COSTS LESS!

For fast service, write, wire or telephone — **DIXON**

The Joseph Dixon Crucible Co., JERSEY CITY 3, N. J.
Crucible & Refractories Division

Temperature Control—Temperature used must be suitable for all the cores in the oven to prevent overbaking and underbaking. A temperature of 170-180° C on the pyrometer provided us an even baking. Actual curing temperature of the core mix is about 145-155° C.

Baking Time—We hold up to 2-5 in. in the conventional type oven for half to three-quarters of an hour and obtain good results. It is preferable to bake cores at a lower temperature for a longer period than at high temperature and shorter cycle.

Moisture Absorption—One problem with resin-bonded cores is their tendency to absorb moisture, particularly when cores are not baked properly. This characteristic may be due to the following reasons, both of which originate from improper baking:

1. Presence of residues of unpolymerized resin during baking. Urea by itself is very hygroscopic, and the degree of absorption depends on the relative humidity. Only a few spots of unpolymerized urea will cause the core to be damp.

2. Polymerized urea resin liberates water during the process of condensation. This moisture liberation occurs step-wise during the reaction. If the curing is not done properly, the cores are hygroscopic and tend to become wet. If cores are pasted, an additional source of moisture is provided by the water in the core paste. Cores should be dried before use to eliminate moisture pickup.

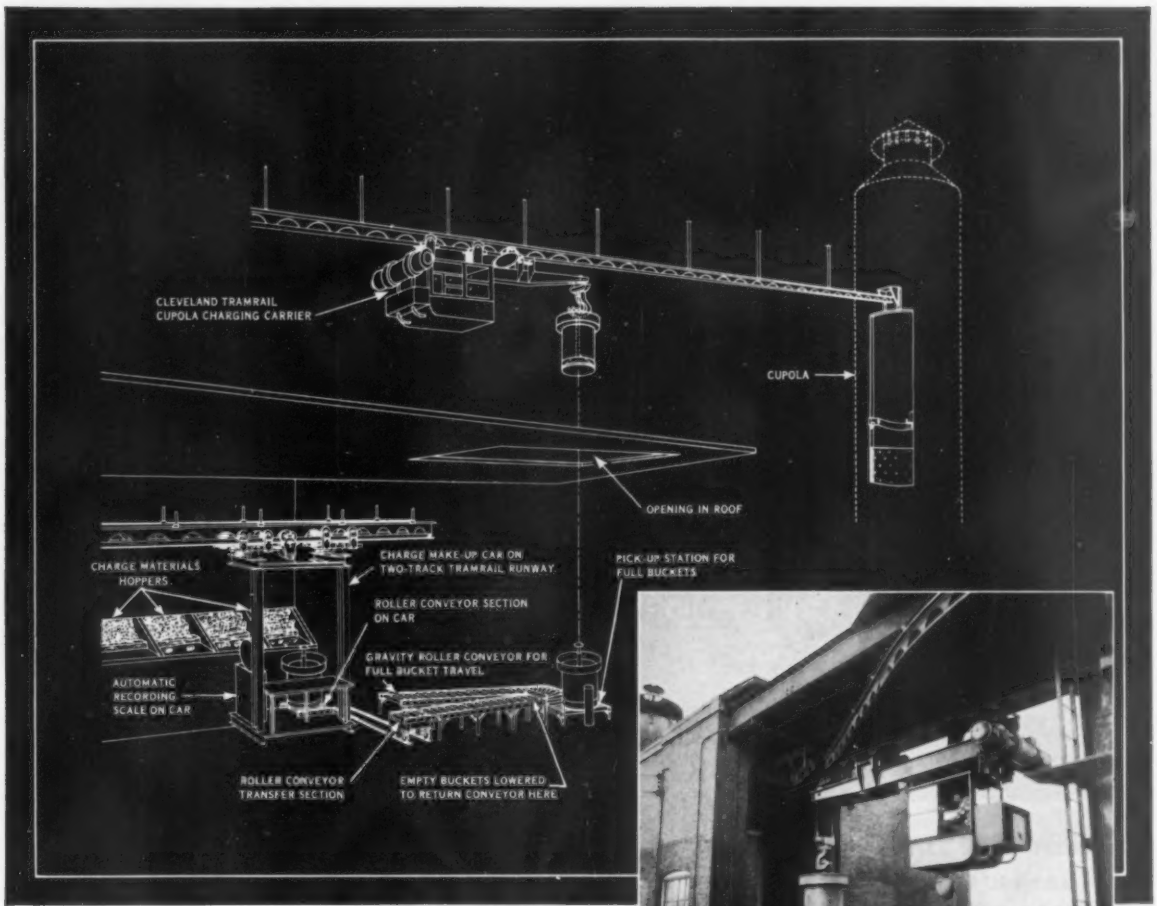
No trouble is encountered with the cores when the molds are poured the same day.

The hygroscopicity and moisture absorption of the core is a function of its dimensions. Smaller cores become wet and distort more readily than bigger ones. Large cores have been left in the mold for several days without any harmful effects.

Properties Improved — This core mix gives much better results than using the usual powdered urea resin and cereal. Except for stickiness caused by the gelatine, most properties of the core were improved, including dry strength and resistance to moisture absorption. More investigation is needed to eliminate stickiness and thereby provide better workability, and to gain more understanding of the reactions and

Cupola Charging Made Fast And Easy

Unique System Reduces Manual Labor to Minimum



Cleveland Tramrail cupola charger approaching the furnace room. The bucket holds 2000 lbs. of charge materials.

ILLUSTRATED here is a dependable tried and proven Cleveland Tramrail cupola charging system that has been in operation at the Standard Foundry Company, Worcester, Mass., for 12 years. This system includes a cab-operated crane in the raw material storage and equipment for making up charges and delivering them to the cupolas.

Charge buckets are filled on the first floor by use of a Tramrail charge make-up car. Materials are fed directly into a bucket as the car moves from one raw materials hopper to another. When full, the bucket travels by gravity roller conveyor to a pick-up station. Here, as illustrated in sketch, the Cleveland Tramrail charging carrier on the second floor level takes over. Without any floor assistance, the hoist hook engages with the bucket stem. The bucket is lifted to high position and delivered directly to cupola. After the charge is dumped, the bucket is lowered to the roller conveyor and returned to the starting point.

The Cleveland Tramrail system is fast, efficient and easy to maintain. It has solved the difficulty of finding men for the laborious work as it was formerly. It has taken the drudgery from the work and elevated the men from laborers to operators.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

Write for free booklet 2008

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 3848 E. 286th St. • WICKLIFFE, OHIO

the mechanism involved when combining materials containing amino acids in the mix.

We use lycopodium as a parting agent to facilitate stripping of the cores. It is an effective parting agent but tends to reduce surface hardness, making the core more friable. Another disadvantage is the loss of time since the corebox must be wiped or sprayed often.

The mixture can be blown satisfactorily if moisture is held to about 2 per cent.

Green strength is the same as with the previous mix. Any tendency toward sagging with large cores was eliminated with addition of small amounts of dextrine.

FEMA Plans Meeting at Greenbrier, Oct. 15-17

The 41st annual meeting of the Foundry Equipment Manufacturers Association will be held at the Greenbrier, White Sulphur Springs, W. Va., Oct. 15 to 17, inclusive.

Meetings on the first day will include information on blast cleaning and tumbling, dust and fume control, flasks and accessories, furnaces and accessories, material handling and processing, and molding and core making machines. In the general business sessions, open discussions will be held on problems affecting the industry, business trends, and the rate of activity in the industry. This year's meeting will feature a panel presentation on "Depreciation and Replacement of Foundry Equipment."

Irwin Such, editor-in-chief, *Steel*, who recently toured the Soviet Union with the U. S. Steel industry group, will present a commentary on Russian political and industrial life. Mrs. Dorothy Such, who accompanied her husband, will discuss the life of Russian women in industry and in the home.

Steel Founders' Fall Meeting To Be Held Sept. 19-22

Fall meeting of the Steel Founders' Society of America will be held at the Homestead, Hot Springs, Va., Sept. 19-22. It will be the 57th annual fall session of the society.

General sessions will start Monday morning, Sept. 21 with President Ross L. Gilmore, Superior Steel & Malleable Castings Co., Benton Harbor, Mich., presiding.

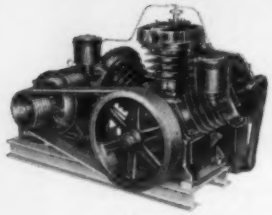
Featured speakers on the program include Dr. Max W. Lightner, vice president-applied research, United States Steel Corp.; J. Keith Louden, executive vice president, Lebanon Steel Foundry; E. J. Behrens, Association Underwriters Co., and Dr. Pierre Rinfret, vice president, Lionel D. Edie Co.

Steel Founders' Society Issues Speaker Directory

Steel Founders' Society of America, 606 Terminal Tower, Cleveland 13, recently published its 1959-60 "Directory of Steel Foundries in the United States, Canada and Mexico." Information is presented on management, personnel, production facilities, types of castings produced, trademark and whether castings are for sale or own use. Steel foundries maintained by U. S. Government Agencies are listed. Price is $15.

Where the going is TOUGHEST the Curtis keeps going!

Sandiest FOUNDRY conditions haven't stopped this CURTIS AIR COMPRESSOR



The CURTIS C-100 two-stage air-cooled air compressor. 25-30-40 H.P.

- CURTIS-SEAL CRANKCASE
- TIMKEN MAIN BEARINGS
- SELF CENTRO-RING OILING
- AIR COOLED: NO COOL WATER REQUIRED
- PRECISION BUILT

For compressed air—industry depends on *Curtis*. Eliminate production line delays. Get more air faster . . . at lower cost. Where the going is toughest (foundry, factory or shipyard) put the CURTIS C-100 to work and forget it!—Full line of industrial compressors for ordinary and special applications.

For complete information write for illustrated folder.

OUR 105th YEAR

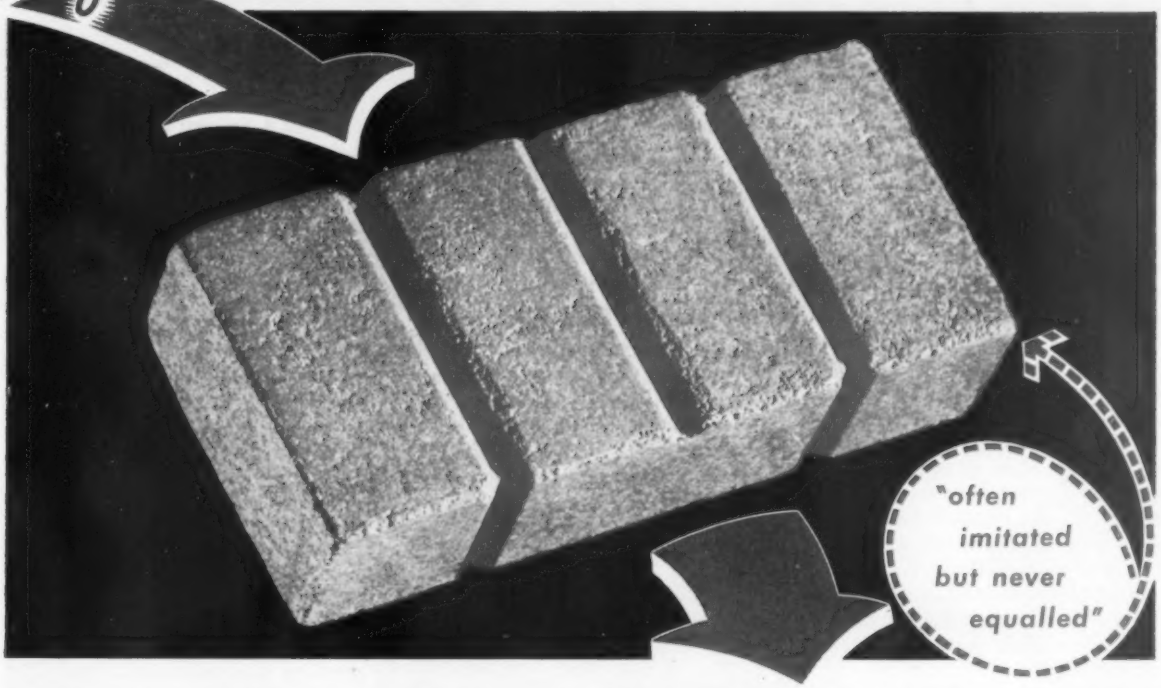
Curtis

MANUFACTURING COMPANY · PNEUMATIC DIVISION

Write Dept. 42, St. Louis 20, Missouri C-62

Gray Iron and Malleable Foundries

prefer Famous CORNELL CUPOLA FLUX



BECAUSE

1. Famous Cornell Cupola Flux makes cleaner iron.

2. Famous Cornell Cupola Flux reduces sulphur content.

3. Famous Cornell Cupola Flux is a scientifically prepared mixture of high-grade fluorspar and other materials which create a chemical reaction in molten iron by greatly increasing slag flow off. Iron is cleaner, castings have greater tensile strength and are easier to machine.

IF ***you melt Aluminum, Brass or Copper, try Famous CORNELL Aluminum, Brass and Copper Flux. Write for Bulletin 46-A.***

The **CLEVELAND FLUX** *Company*

1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES

Trade Mark Registered

Circle 639 on Page 53

Foundry Developments

Lowers Retained Strength

WORK on collapsibility of sodium silicate sand mixes by hot tear tests was reported recently by the British Steel Castings Research Association. It was indicated that additions of organic materials such as cereals, molasses, etc., increase the severity of tearing whereas small additions of clay reduced or prevented tearing.

Although clay additions lower the air-setting strengths of sodium silicate mixes after gassing, they improve the initial green strengths and lower the retained strengths of the mixes after heating within the range of 1300 to 2000° F. The retained strengths after heating within this range are related closely to the knock-out properties of the sand after casting.

Combats Dust Entry

OPERATIONAL failure of the electronically-controlled answering unit at the American exhibit in Moscow from dust kicked up from the concrete floors brings to mind a preventive employed in some foundries to keep dust out of electrical controls. Procedure is to connect the box to a compressed air line and bleed the line so that a small positive pressure is created within the box. The line into the box must be trapped to take out excess moisture, of course, and it may be advisable to include a silica gel trap as well.

Reflects Heat Rays

SPECIAL coating of a metallic oxide integrally bonded to Pyrex infrared glass is reported to reflect almost 90 per cent of the heat and allow a visible transmision of approximately 75 per cent. Designed for protection of workers exposed to intense infrared radiation, the material is said to be tempered to permit use within a few feet of high heat sources without breakage even from flying fragments. The glass, designated IRR, is made by Corning Glass Works and available from Cincinnati Gasket, Packing & Mfg. Co., Cincinnati 10, Ohio.

Speeds Wire Removal

REINFORCING wires in cores in hollow castings are removed easily at Forest City Foundries Co., Cleveland, through use of a special adapter attached to an air-powered Impactool made by Ingersoll-Rand

Co. As shown in the accompanying illustration, a 3/16-in. slot is cut in the end of the anvil extension of the adapter. The slot is placed over the exposed end of the core wire, and when the tool is turned on the wire is coiled around the adapter. It is reported that core wires burned to the casting also are removed successfully.

Has High Hardness

PHYSICAL properties and other characteristics of an aluminum alloy for permanent mold and diecastings which develops high hardness without heat treatment are presented in the article "Ueber eine selbstaushaertende Kokillen-und Druckgusslegierung G-ALSi12Cu3" by August Buckeley in the June 18 issue of *Giesserei* (Duesseldorf, Germany). The alloy contains 9 to 12 per cent Si, 2.5 to 4 per cent Cu, 0.3 per cent Mg, and remainder Al. After 1 to 5 days aging at room temperature the alloy shows 90 to 115 brinell hardness in chill-cast test bars 12 mm diam and 60 mm long. Physical properties are 29,800 to 38,400 psi tensile strength, 24,170 to 34,120 psi yield strength, and up to 1.7 per cent elongation. Modification of the alloy with sodium and water quenching the bars increases tensile strength in the range 35,550 to 45,500 psi, the yield strength 28,440 to 39,800 psi, and elongation 1 to 4 per cent. Brinell remains the same.

Extends Roof Life

ANNUAL report of the British Iron and Steel Research Association mentions that one member firm regularly uses a total-radiation pyrometer to measure roof temperatures of its electric furnaces to facilitate the control of power input. Through that procedure the average life of the roofs of two 6 to 8 ton (long) furnaces has been increased by about 20 per cent without loss of output. Additionally the association in its laboratory has developed an automatic control system which reduces the power input when the roof temperature exceeds a suitable working level.

Rare Earth Properties

NEW handbook on *The Properties of Rare Earth Metals and Compounds* now is available from Rare Earth Research Group, Battelle Memorial Institute, 505 King St., Columbus 1, Ohio. It brings together for the first time the most recently available data on physical, crystal, chemical, mechanical, electrical, magnetic, nuclear, and thermodynamic properties of 15 rare earth metals as well as for yttrium. Book contains 214 pages and includes a 114-item reference list. Price is $10.

People are talking about

7 Borden NEW BINDERS & RESINS

that help solve
core and shell mold problems!

FB26

"Licks the odor problem!"

Odor-free, high-strength urea resin in liquid form. Cures fast. Use for dielectric and conventional baking.

FB113

"Dries cores faster!"

This phenolic resin powder is designed for fast dielectric and conventional baking.

ML-7

"Makes sand mixing easier!"

Resin in alcohol solution. For warm coating shell mold sands for fast mull-out.

ML-9

"Coats sand safely with liquid!"

Single-stage sand coating resin in liquid form for safe, simplified mixing. For warm coating and fast mull-out.

TP27

"Bonds shell molds quickly, securely!"

Assemble shell molds and cores easily and securely with this fast, permanent bonding resin powder. Soluble in alcohol.

MCF-280

"Cuts shell mold cure time by 24%!"

A fast curing powder for shell molds, cores and for coating sand by warm or cold solvent process.

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"A non-alkaline paste that speeds drying!"

A rapid, all-purpose paste gives strong joints in resin, oil, and CO_2 cores.

Convince Yourself with a

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For further information or sample material, contact The Borden Chemical Company, Dept. F-99, 350 Madison Avenue, New York 17, N. Y.

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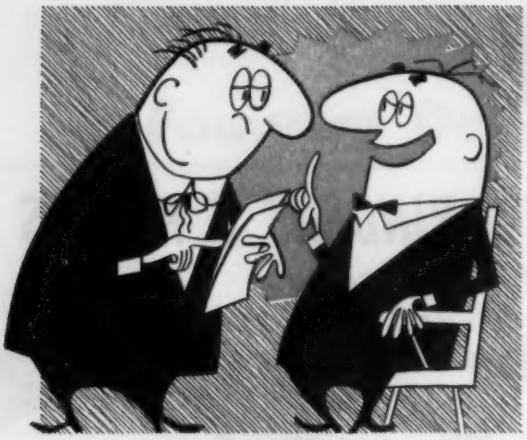

By HAROLD L. SANDERS
Manager of Purchases
Pesco Products Div.
Borg-Warner Corp.
Bedford, Ohio

What the Castings Buyer Expects of the Foundry

● THREE THINGS are important to a castings buyer. In order of importance they are quality, delivery, and price.

How many foundries can say that they are satisfied completely with the quality of the castings they are producing? How many know that there is not going to be a rejection at the customer's plant because the castings have not been thoroughly checked before leaving their plant? How many have a quality control manager who does not report to the production manager but instead to someone higher up so that he can not be ordered to accept castings that may not be up to his quality standards?

Too many castings are being rejected by the customer for visual discrepancies that should have been caught in the foundry's inspection. Discrepancies such as blow holes, sand holes, porosity, wires in core holes, excessive snagging, cracked castings, and excessive core shift can be spotted by visual inspection. When we receive castings with these discrepancies it is obvious that there has been no inspection.

You should not expect the customer to be your inspection department, nor should you ship the castings knowing something is wrong and hoping the customer does not catch the errors. This applies to samples also. While we're laying out the sample casting you should be laying out one, too, so that we can compare results. Don't just wait for us to tell you what is wrong with it.

Build Quality into Castings—Quality, of course, cannot be inspected into a casting. The real place to control the quality of your castings is in the foundry. This begins with the pattern itself. It is penny-wise and dollar-foolish to scrimp on a pattern to save a few dollars and have a greater loss in scrap castings or in excessive time spent in attempting to juggle cores back and forth, or to rub cores to "make them do." Gages should be included with the pattern costs to check cores. If they are out of dimension, it is less expensive to throw them away than to take a chance on using them and hoping the casting comes out all right.

Castings buyers have a term that we use as a crutch to cover most of the other discrepancies that are not found at receiving inspection. This term is "latent defects." In this category are items such as internal porosity that does not show up until the part is being machined.

By the time the customer discovers the trouble, he usually has considerable machining expense tied up in the part. You, of course, take back the casting and allow credit for the value of it, but the cost of the machining sometimes far outweighs the casting cost. Usually, by the time the discrepancy is discovered, we are coming down the "home stretch" as far as lead time is concerned, and there is not enough time to run replacement castings and still make our production schedules. What can we expect you to do to correct this situation?

One thing you can do is cut up castings on the sampling plan to check for porosity and blow holes. You can control metal, analyze pattern design, and have castings x-rayed on a sampling basis. Fluorescent penetrant inspection will show any surface cracks that might be present. These things might sound expensive, and some of them are, but in the long run I think you will find they are worthwhile.

Clean the Castings—Another quality point overlooked in some foundries is good clean-up practice. By this I mean properly cutting off gates and risers and performing snagging operations. On some castings, blasting cleaning might be necessary. General appearance has a lot to do with how close some inspectors look at castings, and good, clean castings will go a long way toward improving supplier-customer relationships.

We do not have much trouble with metallurgical quality. Most foundries use some method of checking the analysis of the metal being poured. With new alloys constantly being introduced, many of them having narrower ranges for alloy constituents, there is no room for relaxation on metallurgical control.

Delivery Time—Probably one of the most annoying things you keep hearing from your customers is this matter of delivery time. Due to the accelerated pace of today's business and the rapid technological progress being made in all areas of industry, lead times must be shortened. We know of your production problems and we appreciate them,

SALVAGE YOUR VALUABLE MOLDING SAND with a SIMPLICITY RING-TYPE CRUSHER SCREEN

188

You profit two ways with Simplicity's Ring-Type Crusher Screens

- Your used core and molding sand is crushed and screened for re-use in one operation, saving the cost of new sand.
- Transportation and dumping costs of used sand are eliminated.

This unit combines the Simplicity heavy-duty vibrating screen with free-turning cast rings mounted over crushing plates. One to three sets of rings can be supplied, depending upon the maximum lump size to be crushed.

Simplicity ring-type crusher screens are paying their way in foundries producing magnesium, steel, malleable and grey iron castings throughout the United States.

Available in many models and sizes. For complete information write today for the name of our sales engineer in your area; and turn your waste into profits.

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario.
FOR EXPORT: Brown and Sites, 50 Church Street, New York 7, N. Y.

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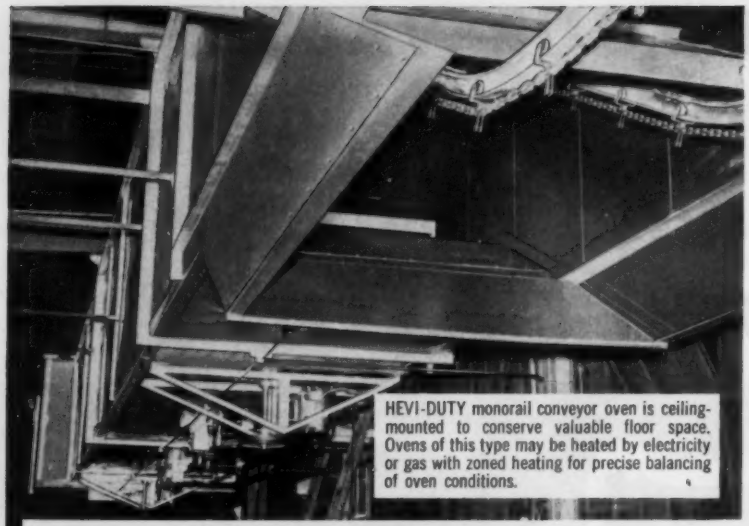
ENGINEERING COMPANY • DURAND 7, MICHIGAN



HEVI-DUTY monorail conveyor oven is ceiling-mounted to conserve valuable floor space. Ovens of this type may be heated by electricity or gas with zoned heating for precise balancing of oven conditions.

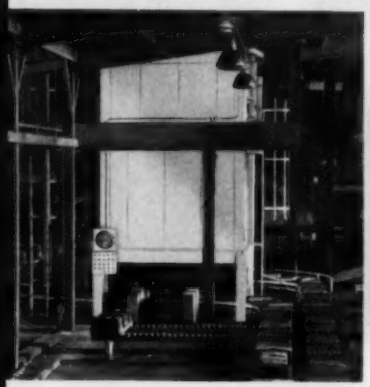
HEVI-DUTY

now offers a complete industrial oven line

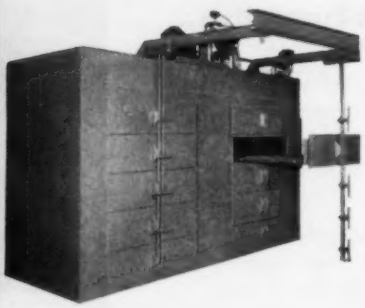
The recent purchase of the Sermax Corporation, Milwaukee, has rounded out HEVI-DUTY'S line of industrial heat processing equipment.

HEVI-DUTY now produces electric, steam heated and fuel-fired ovens. They range in size from a 15-inch diameter model for laboratory use to industrial conveyor, tower, and batch type ovens capable of handling large sand cores, castings, and fabrications.

Write for Bulletin 159 for further details.



A HEVI-DUTY tower type oven. In this oven, heating is supplied in the tower section followed by cooling in a pit below. Stabilized trays are automatically loaded and unloaded. Continuous processing with consistent results is obtained in a unit that requires minimum floor space.



HEVI-DUTY drawer-type ovens offer flexibility for processing small batch loads. In the model shown, ten batches may be heated at the same time, yet each may be removed without disturbing the others.

HEVI-DUTY

A DIVISION OF BP C BASIC PRODUCTS CORPORATION

HEVI-DUTY ELECTRIC COMPANY, MILWAUKEE 1, WISCONSIN

Industrial Furnaces and Ovens, Electric and Fuel • Laboratory Furnaces • Dry Type Transformers • Constant Current Regulators

but remember we have our problems, too. We do not ask for the castings in two weeks so that they can lay around and age in our shop for a couple of months before we begin machining.

We are selling lead time for our products and so are your other customers. Lead time these days is a very important factor as to who gets the order, no matter what business you are in. Foundries are at the beginning of the line. After the shipping department, assembly department, test department, and all manufacturing operations take their cut out of the total lead time, you get what's left. Some of you are doing remarkably well in meeting the very short delivery dates required, and I think it would behoove you to talk about it among yourselves and try to determine how some of you are able to do it.

An important factor concerning delivery is proper production control and follow-up within your foundries. We expect accurate and reliable information as to the status of open orders, and you must have proper records to give it to us. We do not want the orders to be swallowed up in your operation so that you are unable to tell us the status of the castings until they come out the back door.

We also expect realistic information. Do not just tell us what we want to hear to keep us temporarily satisfied, because we will be planning our production schedules on what you say. If the delivery does not look good, let us know as soon as possible; maybe we can authorize overtime to help out or switch some jobs around so some of the most urgent ones are done first.

Want Service from Salesmen— Then there is the matter of service. This is where your salesmen come into the act. They keep you informed on the happenings and business conditions at the customer's plant, and they keep the customer apprised of developments and progress at the foundry. Since he is the liaison between the two parties, isn't it obvious that he should have the delivery and status information and carry it into the customer's plant with him? What a blessing it is to have a salesman come into the office and have all the up-to-date information with him on the status of the orders and when the castings

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are going to be delivered. Do you know of any reason why your salesmen should not have this information?

The buyers your people call on are busy and need all the help they can get. The role of salesmen calling on customers asking "When am I going to get an order" is fast disappearing. The need now is for service engineers. They can keep the buyer up to date on matters of interest at the foundry, new equipment, expanded facilities, new processes, personnel changes, and the like. They are able to analyze blueprints of castings that the buyer might have to purchase and be able to discuss them from a technical standpoint as to how the castings should be parted, the best method of casting, and approximate costs of castings and tooling. They would know if their foundry is equipped for that particular type of job.

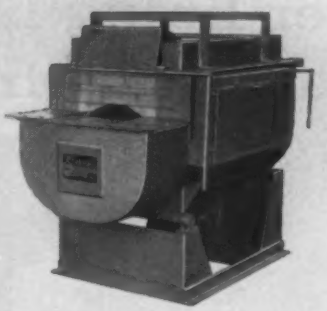
Salesman's Responsibility

One of the most important responsibilities of salesmen is taking the buyer's problems back to the foundry. Rejection reports received from the buyer should be discussed with the salesmen, and some action on the salesmen's part should be expected. When your salesman does come back to the plant with a customer's complaint, do not accuse him of taking the customer's side of the issue; look into the matter. We should not have to go any farther than the salesman with our problems and complaints.

Here's one more point for salesmen. Buyers are very busy people; please respect their time when you call on them. Do not go off on a tangent or enter into long dissertations about something that is irrelevant to the matter at hand. We do not have the time, and you should not have the time either.

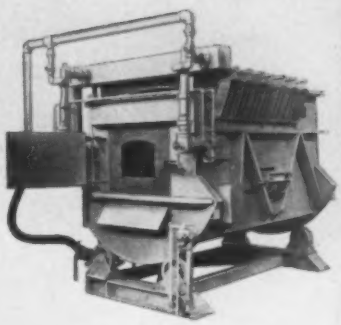
I have talked a lot about what we do want from you. Now I would like to tell you what we do not want from you. It is very important in buyer-seller dealings that our contacts be on a plane where there can be no doubt concerning the propriety of our business relationship. The eyes of a great many people are upon us, and we have to insure that our conduct is such that we do nothing to give the impression that there is anything in

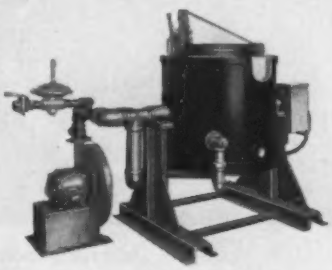
HEVI-DUTY adds STROMAN to its Fine Line of Furnaces



Electric Resistance Holding Furnace—Available in several capacities for holding molten aluminum for die casting and permanent mold work.

Reverberatory Furnaces — for breakdown of non-ferrous metals to supply hot metal to holding furnaces. Can be supplied with gas or oil or combination burners. Hydraulic tilting mechanism. Also available are double chamber furnaces for melting and holding in the same furnace.





Crucible Melting Furnaces — for brass, bronze, aluminum and other non-ferrous metals. Stationary or tilting may be tilted manually, hydraulically, mechanically, or by independent hoist. Wide range of sizes.

The Stroman Furnace and Engineering Company, manufacturers of non-ferrous metal melting furnaces and other foundry equipment, has been purchased by Hevi-Duty Electric Company.

The wide range of Stroman-designed foundry equipment will now be produced at Hevi-Duty's new Watertown, Wisconsin, plant. All Stroman equipment now in use will be serviced by Hevi-Duty. For more information, write Hevi-Duty Electric Company, Milwaukee 1, Wisconsin.

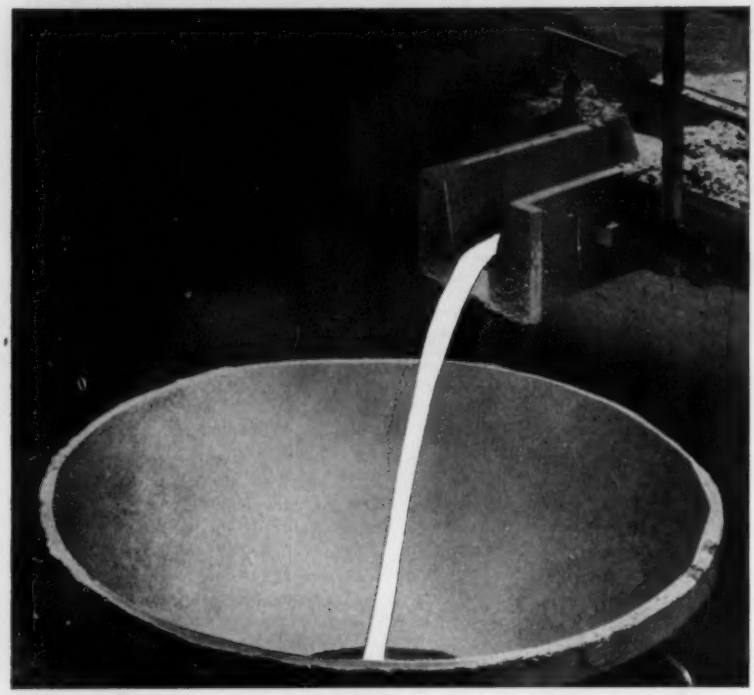
- Industrial Furnaces Electric and Fuel
- Laboratory Furnaces
- Dry Type Transformers
- Constant Current Regulators

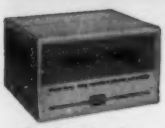
HEVI-DUTY ELECTRIC CO.
Milwaukee 1, Wisconsin

Circle 643 on Page 53

FOR AREAS WHERE MOLTEN IRON IS ON THE MOVE

Porter Anti-Slag, the plastic refractory that gives longer lining life under severe slagging





Cupola spout areas, ladles, runners . . . wherever molten iron is moving . . . that's Anti-Slag territory! Anti-Slag Plastic, companion refractory to Porter's famous Slagtite, gives you highest resistance to your tough slagging conditions.

Refractories with graphite, pioneered by Porter's Laclede-Christy Works, provide cleaner metals, less refractory inclusions and cut casting scrap. Now, Anti-Slag adds easier slag cleaning and reduces "wetting," particularly in areas where oxidation and carbon pick-up are not factors. Periodic washing with Porter Slagtite Mortar and Coating will add even longer life to Anti-Slag.

Let us help you determine the *proper* graphite refractory (Slagtite or Anti-Slag) for your application. Available in plastic or dry form. Write: *Refractories Division, H. K. Porter Company, Inc., Porter Building. Pittsburgh 19, Pa.*

REFRACTORIES PORTER DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Copper and Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

our actions that would bring discredit upon ourselves or our company. We ask your help and cooperation in this matter.

No buyer can engage in any off-color dealings without the encouragement and support of a salesman or company representative. Conduct your business with integrity and you will find many friends in the purchasing profession who will deem it an honor and a pleasure to do business with you.

What about Price?—In conjunction with more efficient purchasing, price does not mean pitting one foundry against another in a low bid contest. This might save a little money temporarily but also might end up costing much more than is saved. The right price is one that is the best price after the factors of quality and delivery have been considered.

An important point to consider in evaluating the price is whether the casting is being made by the best method in relation to the quantity of pieces desired and the application of the casting. You might be submitting a price on a casting, allowing only a small margin of profit, and have another company underbid you, allowing a larger percentage of profit. Why? Usually because the other fellow has a better, faster way of producing the same casting. That is why it is important to keep up with all technical advances in the foundry industry; read foundry publications; attend the foundrymen's conventions and meetings. Find out what the other fellow does that allows him to keep the price down.

When we ask for bids on new castings we usually have a time limit in which we want the bid returned. Respect this time limit because any delay in receiving the price and placing the order means that much less lead time for the successful bidder to make the casting—and that successful bidder might be you. Once you do get a job and there are repeat orders, please evaluate your costs and submit a new bid. Often, economies are effected in production after the initial order due to experience gained. But these economies somehow do not end up in lower prices.

We want you to play fair with us at all times. If you have a price problem, bring it in; let's talk about

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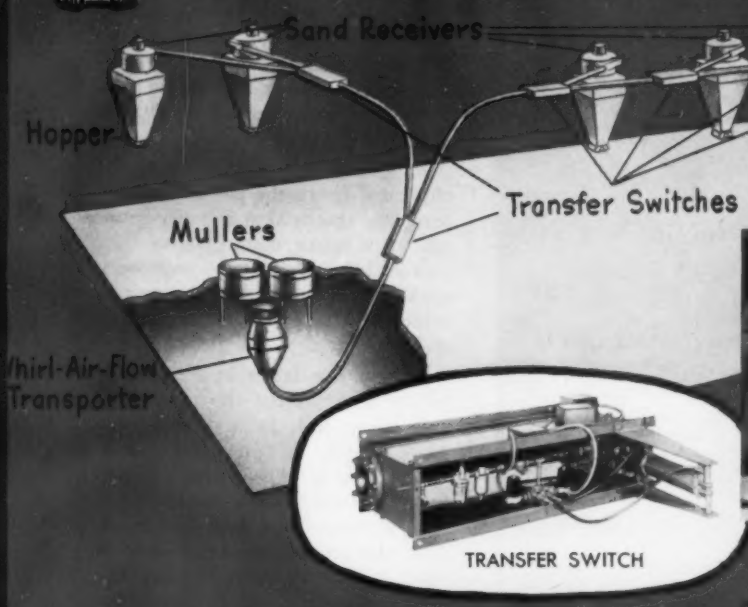
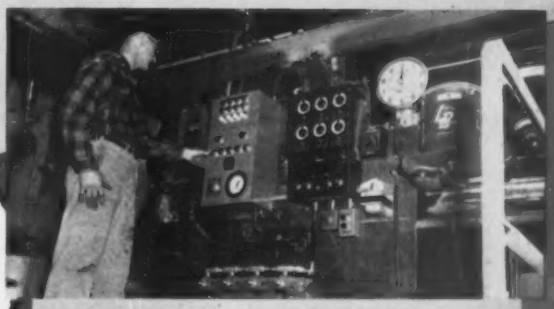
Circle 645 on Page 53→

Pneumatic Handling of Core Sand

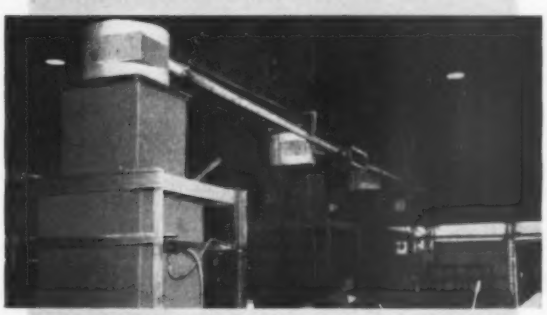


Transfer Switch permits delivery of material to any desired location. Work stations or storage can be located for best operation. Each transfer switch provides up to 3 way distribution as illustrated.



Press A Button—Dispatch sand to any of the 4 stations at the Gisholt Machine Company foundry.

Muller discharges sand into the transporter and the switch directs it to large and small core rooms.



3 work stations in line receive sand as needed from transporter.

No maintenance is required—4" tube is large enough to supply this station in a remote part of the foundry with ample sand supply.

70% Cut In Sand Handling Time With WHIRL-AIR-FLOW System Reported By Gisholt Machine Co.

Confusion and production delays caused by use of overhead cranes when used to deliver core sands were reduced with the installation of Whirl-Air-Flow system.

After 3 trouble-free years experience with the Whirl-Air-Flow system in their Madison, Wisconsin foundry Gisholt Machine Company reports—One man now handles the entire sand distributing requirements to all work stations and all storage locations. (Two men were used full time on this job before, plus crane operator and crane.) With the addition of one transfer switch, one hopper and necessary tubing, facing materials can be delivered to the main bay with the present transporter without any additional labor.

Write, wire or phone. Find out how Whirl-Air-Flow can help you !

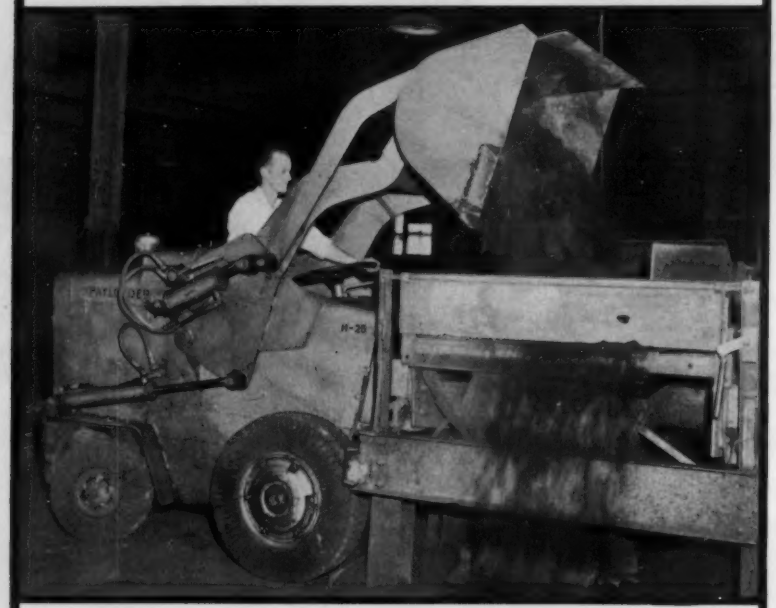
WHIRL AIR FLOW

WHIRL-AIR-FLOW

FEderal 9-0231

650 25th Avenue S. E., Minneapolis 14, Minnesota

Users Report on Advantages



of Model H-25 PAYLOADER®

"H-25 'PAYLOADER' is superior to any previous sand moving equipment used — does many jobs previously impossible with our other loaders . . . offers such advantages as bigger payloads, faster and more powerful, plus a considerably shorter turning radius", says O. W. Street, Supt., Parker-Street Castings Co., Cleveland, Ohio.

"Short turning radius enables it to work in close areas where the two loaders it replaced could not. It has cut the overall work period in the night crew operation from 11 to 6 hours without changing floor working conditions", says Supt. Lawrence Parker, Rollstone Foundry, Inc., Fitchburg, Mass.

"Power Steering gives the operator better control . . . is a great help in crowded conditions like ours", says Orrin Holm, Foreman of Baker Mfg. Co.'s foundry, Evansville, Wis.

"Power-shift transmission and power-steering makes it easy to operate and do a better, faster job . . . has saved at least an hour a day", says C. B. Kelton, Mgr., Decatur Foundry, Inc., Decatur, Ill.

If you want to find out what a Model H-25 can do, ask your Hough Distributor for a demonstration. See how power-steer, power-shift, "no-spin" differentials, 6-ft. turning radius, 2,500 lb. carry capacity, 4,500 lb. bucket breakout force and other H-25 features get the work done faster, better, at lower cost.

PROVEN 'PAYLOADER' MODELS — are available for every material handling purpose, indoors or outdoors . . . carry capacities from 2,000 to 12,000 lbs. . . . and a Hough Distributor nearby to serve you.

HOUGH®

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THE FRANK G. HOUGH CO.
703 Sunnyside Ave., Libertyville, Ill.
Send Model H-25 "PAYLOADER" data 9-A-2

Name.....
Title.....
Company.....
Street.....
City.....State.....

it. I don't believe it is good business to be losing money on one casting with a customer and making an excess profit on another casting with the same customer and figure that one offsets the other and everything is fine.

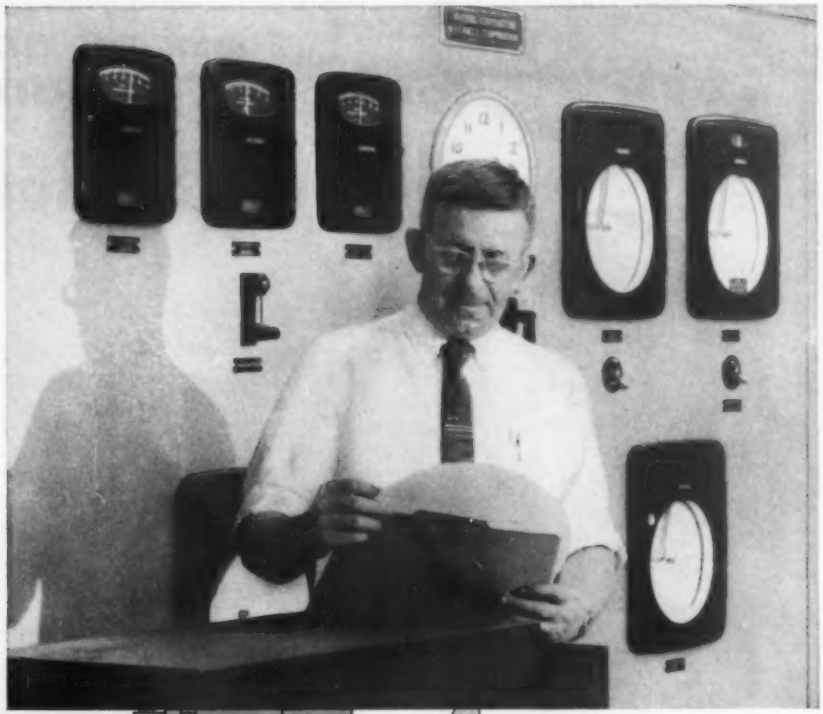
In good times or bad when the chips are down, the pot goes to the company that makes a better product at a lower cost. Quality is a partnership team of engineers, workers, factory people, office people, salesmen, inspectors, shippers — everyone.

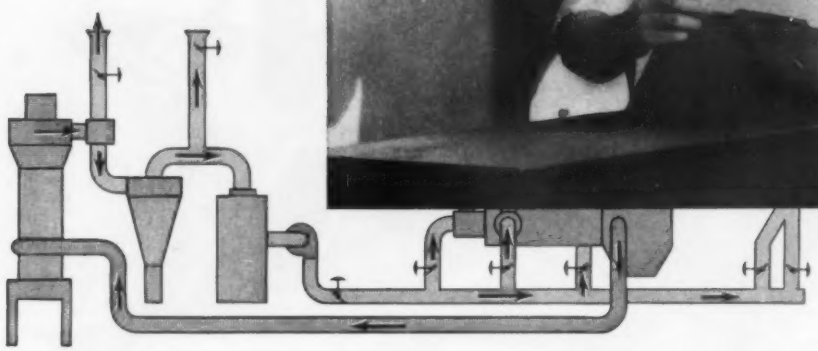
Quality is a factor in a sweeper's broom which keeps the place neat and clean; it is in a receptionist's smile which tells a caller he is welcome; it is in a worker's skilled hands trained to close tolerances; it is in a supervisor's guidance which gives the people the opportunity to grow; it is in an inspector's promise that the quality will be consistent; it is the imagination of the engineer who is unimpressed by precedent, and it is in a salesman's pride conveyed from all employees to the customer.

The Buyers' Obligation—The relationship between buyer and seller is a business partnership. Therefore, we have an obligation to you just as you have one to us. When you call on us you should expect to be treated fairly and with respect. This means that you should not be kept waiting unnecessarily in our lobby. If we have certain hours and days for visiting, please abide by these rules. They help you by allowing time for the buyer to conduct other business, including placing purchase orders.

We should not ask you to bid on something we have no intention of buying merely to use your price as a lever on our present supplier. It costs money to prepare a quotation, and it is very discouraging when you find out that this item is being used on merely a "dry run." We also should not ask you to bid on an item that we know you are not qualified to make. We believe in fair competitive bidding from companies who can qualify. We always should welcome and encourage your suggestions. They are to our mutual benefit.

Editor's Note: This article is based on a paper presented by Mr. Sanders before a meeting of the Northern Ohio Management Group, Non-Ferrous Founders' Society, Cleveland, May 28, 1959.





Increased efficiency, lower operating costs

with Foxboro Complete Hot Blast Cupola Control

Complete instrumentation for any Hot Blast Cupola system — simple or complex. And every instrument one that's been field-proved in hundreds of foundry installations. Ask your nearby Foxboro Field Engineer for full details on the cupola control instruments listed below — or write Foxboro direct.

Air Weight Controllers

Performance-proved in more than 1700 successful installations. These popular Foxboro Controllers automatically "weigh" air for cupola blast... provide right amount of oxygen for best combustion regardless of weather conditions. Results: higher quality castings, greater productivity . . . fuel savings and less pigging. Write for Bulletin 10-10.

Dew Point Recorders – Controllers

These Foxboro Instruments, with the exclusive Dewcel* measuring element, reduce coke waste and "cold metal" pours. Dew Point Recorders provide a fool-proof basis for modifying the formula under varying humidity conditions. Dew Point Controllers automatically compensate for blast moisture variations on long-run heats. Write for Bulletin 11-11.

Pressure Recorders

These "trouble-shooting" recorders give operators a continuous record of cupola conditions . . . show-up clogged tuyeres, bridging, fine coke sizes, etc. They're dependable, accurate, trouble-free performers. Write for Bulletin 6-10.

Temperature Controllers

For precise control of cupola start-up operation, windbox blast air, dust collector inlet gas, and hot air generator exhaust gases. Write for Bulletin 14-10.

Other Foxboro efficiency boosters: Blast Pressure Recorders • Temperature Controllers for Pre-Heaters Pressure Controllers for Exhaust Systems • Temperature Protection for Fans and Dust Collectors.

The Foxboro Company, 329 Neponset Avenue, Foxboro, Massachusetts.

*Trade Mark

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COMPLETE FOUNDRY INSTRUMENTATION

Circle 647 on Page 53

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Better grinding evident in fast stock removal with less wheel wear! That's why Simonds Snagging Wheels get the nod of approval in leading foundries, steel mills and metal-working plants. Resinoid bonded wheels contain a special additive that provides an internal lubricant for better grinding action . . . and are identified by new short markings, A166-R, C16-S, etc. Vitrified bonded wheels for gray iron contain V9 Bond, a chemically designed glass bond for greater uniformity and consistently superior performance.

Write for Bulletin ESA-305

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Man to Man

By RALPH L. LEE, *President*

Lee Hobby Foundry
Birmingham, Mich.

"Even with the most precise tests for the conglomeration we call molding sand, other things can go right or wrong in the foundry"

Adventures in Sand Testing

● ABOUT five years ago, I was having one heck of a time trying to make an altar cross casting in a large, rather shallow flask. In spite of bars, gaggers, and nails, the cope persisted in dropping. Frustration overwhelmed me.

Although I recognized that ignorance and lack of skill were the principal causes of my problem, I also suspected just about every other possible reason for the mess I was in. Finally, sand seemed to be the most likely culprit.

Using Albany No. 0 for a smooth finish, I checked the moisture content range and used the time-honored hand squeeze and roll test for strength. My sand heap was on the skimpy side, and, since I had no mixer except a shovel and sweat, it had been used over and over again. Consequently, I had serious doubts as to whether or not it had seen its best days and was ready for the dump. I finally got the casting—how I got it is too long a story to tell at this point.

When To Dump—But the question of wornout sand started me on the quest of a simple method of determining when the heap should go to the dump or when new sand should be added. I'll have to admit that in the adventure of the search I frequently lost sight of what I started out to do and doodled around rather promiscuously in sand testing. After filling two fat notebooks with the resulting data and building all sorts of Goldberg apparatus, I still had to admit that I was not yet in a position to swear on a stack of Bibles when my sand heap was truly worn out. Even so, I feel that I learned a thing or two as I followed the zigzag trail.

First, I was forced to admit that when you get right down to brass tacks, the best possible test for molding sand is the casting you shake out from it. Although this observation is almost too elementary and obvious to mention, I found myself losing sight of it while working myself up to a tizzy with curves, slide rule slippings, and logarithms.

Another thing dawned on me: There I was looking on a conglomerate mixture of miniature rocks, mineral flour, and clay as though it were a metal alloy of some kind. I was trying to use practically the same tests devised for determining the hardness, compression strength, tensile strength, and ductility of metals or other solids.

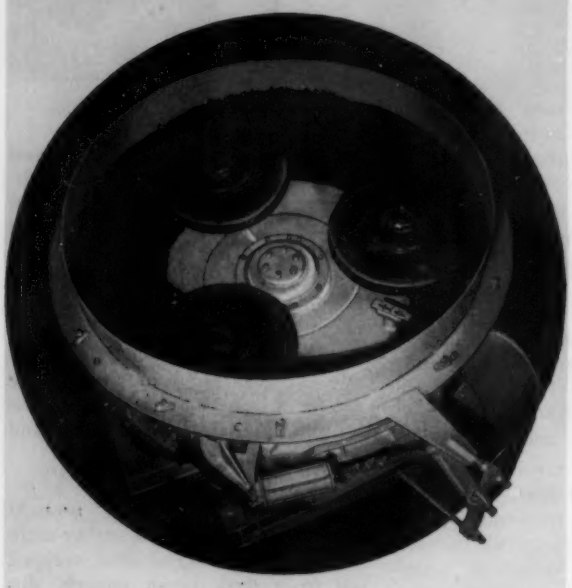
Do you have tired, wornout sand?

From the beginning of my sand testing binge, I had the dream of setting up sand testing conditions which would imitate as nearly as possible those encountered in an actual mold, in which the sand mix is called on to withstand the pressure of the liquid metal and the erosion of its flow, as well as the stresses involved in making and handling the mold.

It's Different—My failure to accomplish this goal fully brought me face to face with a rather stubborn fact: A body of sand wrapped up in a flask is an entirely different breed of cats from a little cylindrical sand heap standing on its bottom out in the open, so to speak. Then it occurred to me that the flask is really the skin of a sand mold and that the strength of that sand leans heavily on its skin. Of course, I also had to remember bars, gaggers, nails, and other reinforcements, to say nothing of core wires and armatures.

Another thing made me wonder about this sand skin situation: I finally traced the source of some unaccountable variations in tests on the same, well mixed, tempered sand. They were due to nicks I hadn't realized I was putting in my naked, rammed-up sand speciman. This fact suggested that even without a flask, the skin of the specimen was a factor in re-

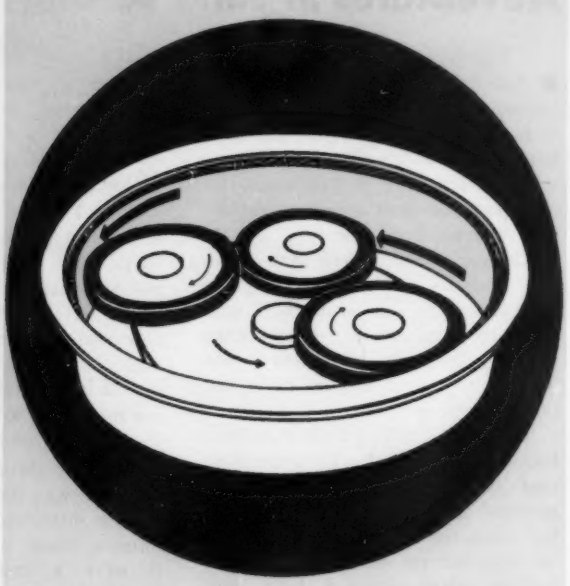
50% MORE HOURLY CAPACITY FOR LESS MONEY...



"AERATION AND COOLING IN THE MULLOR"

Our "slow" mixer had always required an external aerator . . . that meant an additional investment and additional maintenance, too. We saw that Speedmullor mulling in suspension actually provides more thorough aeration than could ever be accomplished by a separate aerator. Most foundries reported that their sand was up to 25% lighter in weight per cubic foot on discharge from a Speedmullor . . . that's real aeration.

Speedmullor Cooling offers a real advantage, too. We mull hot shakeout sand and it has to be cooled before use. With Speedmullor Cooling we can force cooling air right through the sand and accomplish real cooling *in* the mullor . . . that eliminates an expensive external cooling unit.



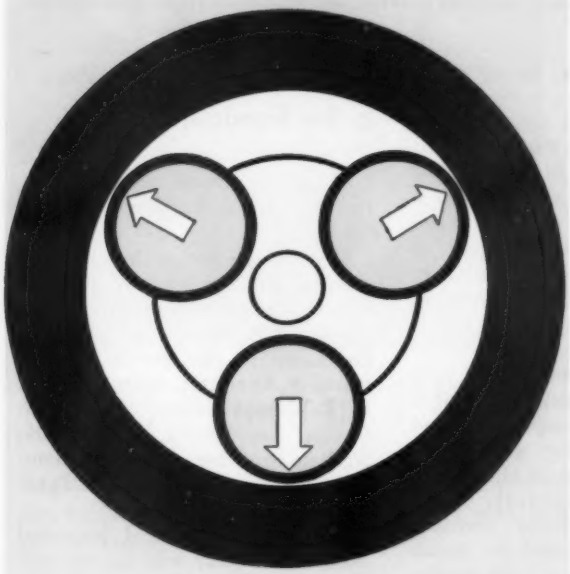
"REAL CAPACITY PLUS MAXIMUM MULLING"

We found that there was no mystery to the output advantage of Speedmullors. We had known that mulling was merely the application of work energy to the sand mixture to obtain a squeezing and kneading, coating action. The work has to be applied as pressure over an area of sand. Speedmullors utilize centrifugal force to apply even greater pressure than the heavy mulling wheels of a "slow" mixer. Yet, the mulling wheels of a Model "80A" Speedmullor cover three times the area covered by the slow moving wheels of the largest conventional mixer. The result is over three times the mulling.

In our "slow" mixer there's a lot of slippage, too. Sometimes the big steel wheels just slide around instead of rotating. With Speedmullor rubber-to-rubber mulling, there can be no slippage . . . and there's better mulling with rubber, too.

. . . that's why we bought SPEEDMULLOR*

Our mulled sand requirements had increased steadily, until our conventional "slow" muller just couldn't keep up, *and* provide the quality we needed, too. When the time came for its replacement, we figured we would have to install two new mullers. That's when we decided to investigate Speedmullors, although some of our "old timers," accustomed to "slow" mixing for so long, were hesitant. We thoroughly checked Speedmullor users on their performance and capacity, and that's when we really got interested.



"CENTRIFUGAL FORCE SPEEDS DISCHARGE"

The time required for discharge in our "slow" muller (25 to 35 seconds) had always seemed long and wasteful. There's no mulling accomplished during discharge and a slow discharge really cuts into capacity. The Speedmullor uses centrifugal force to discharge the sand, too . . . and it's really fast. A complete, thorough discharge requires only 7 to 11 seconds in the Speedmullor. Faster mulling and faster discharge add up to lower power cost . . . even with the more powerful Speedmullor. My car is more powerful today than was one thirty years ago, but it sure goes a lot farther on a gallon of gas.

"THERE'S NO MYSTERY TO MULLING"

We learned that Speedmullor mulling *fully* develops physical properties in mulling cycles less than one-third as long as in our conventional muller. With over three times as many batches per hour, the Speedmullor more than offsets the larger batch size of our conventional mixer. In fact, an "80A" Speedmullor provides more than 50% greater *hourly* capacity of fully mulled sand than the largest size conventional mixer . . . and would meet our capacity needs at lower cost.

***One of 863 foundries that have *replaced* conventional "slow" mixers with Speedmullors.**

902 foundries have placed repeat orders for Speedmullors. One single foundry has 39 Speedmullors in operation, and one single company has 72 Speedmullors in operation.

TODAY, MORE FOUNDRY SAND IS MULLED IN SPEEDMULLORS THAN IN ANY OTHER MULLERS

PROGRESSIVE FOUNDRIES LOOK TO
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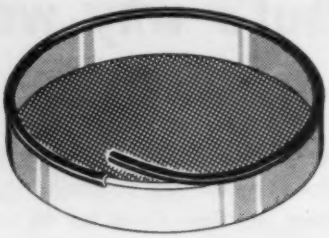
Circle 649 on Page 53

HOW To Do It

FOUNDRY will pay a minimum of $15 for each "How To Do It" idea submitted and published

Old Hose Prevents Slivers



By JOHN D. SWAB
President
Acme Brass & Aluminum Foundry
Marshalltown, Iowa

MOLDERS in our brass and aluminum jobbing foundry had complained about cutting their hands and getting slivers from the worn top edge of wood bound, hand riddles. We eliminated the injuries by splitting used, ¼-in. air hose and forcing the split hose over the top edge of the wood binding on the riddles. Small brads are used to secure the hose in place. Complaints have stopped, and, in addition, serviceable life of the riddles has been increased.

peatable tests. I rigged up a way to avoid the nicks and was delighted to find a much greater consistency in repeatability.

I have good reasons for believing that my imagination is not responsible for the following conclusion: In either ramming or squeezing a specimen, grain-on-grain bridging against the walls of the container forms rather erratic reinforcements or jammings which prevent consistent densities. I found that by rapping the specimen container while the sand was being either rammed or squeezed, I was able to get my first consistent results. I now use a small electric vibrator; in fact, I don't know what I'd do without it. To my way of thinking, this vibration thing raises some rather exciting possibilities in the whole field of molding. After all, a peck of walnuts shaken down is a little different from a peck that isn't.

Since most of the castings made in the Lee Hobby Foundry are on the small side—rather intricate and nonferrous—Albany No. 0 is more or less standard with us. (We have other sand too.) But Albany is weak in comparison with synthetics; so testing it accurately with consistent and repeatable results is a real challenge, at least for us. If we can manage this sand, we ought to do pretty well with others.

Learned a Bit—Although the results of this adventure in sand testing provide no great occasion for raising the flag or tooting the horn, I am content with the feeling that the old amateur, besides being kept out of poolrooms, has had some good clean fun and learned a bit here and there along the way. With forgivable pride (I blush), I have been able to run six consecutive strength tests on a given sand sample and, without fudging or gilding the lily one teeny bit, come through with a maximum variation of slightly under 4 per cent.

I have played the scale of moisture content from 3 per cent to 9, found the peak in strength (broader than I suspected), and determined the dry spot where strength jumped over the cliff (much narrower than I suspected).

I have run squeeze pressures from 3 to 90 psi, located the ramoff spot, and discovered a wide permissible band of pressures for the same strength. I guess I've just scratched the surface, for there are many side trips I'd like to take. They will be fun, too. Is there any greater fun than searching for the truth?

In my present frame of mind, I conclude this little adventure with this observation: Even with the most precise, repeatable, and provable tests for the conglomeration that we call molding sand, a lot of other things can go right or wrong in this intriguing cast metals art.

With all of this water now over the dam, I feel a little more comfortable in deciding when to add new sand or throw out the old, although I instinctively grab a handful just for the heck of it and still have dropouts now and then.

Gray Iron Founders To Meet In San Francisco, Oct. 7-9

Gray Iron Founders' Society will hold its 31st annual meeting at the Fairmont Hotel, San Francisco, Oct. 7-9.

Keynote speakers of the three-day meeting are Dr. John W. Van de Water, director of executive development, University of California; Dr. Louis F. Hackemann, Hackemann & Associates, Sausalito, Cal.; H. R. Clauser, editor, *Materials in Design Engineering*, New York; Sterling Brubaker, associate economist, Bank or America, San Francisco.

A panel of technical personnel from the industry will discuss various technical problems.

Frank G. Steinebach, editor, FOUNDRY, will represent the Foundry Educational Foundation, Cleveland. Richard Meloy and Charles Walton, society staff members, will also participate in the program.

Presentations of the Association's top honors and awards will be made at a luncheon on Friday, Oct. 9.

Also of interest to the gray iron industry will be the naming, on Friday, of the winners of the GIFS 1959 Design Contest. H. R. Clauser, chairman of the judging committee, will present the awards. Society President A. M. Nutter will preside.

During the three days, the board of directors meet in two sessions, Wednesday and Saturday, to elect new officers and conduct the regular business of the organization.

LARGE...

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there is a grade of **PENN-SAND** for every type of core

Regardless of size, metals poured or core process used, we can supply a grade of Penn-Sand to meet your most exacting requirements.

Whether you are pouring steel, gray iron or non-ferrous metals—whether you use core oil, bentonite, cold-set binders, the CO_2 process or make shell cores—Penn-Sand will help you produce better cores at lower cost.

The secret is Penn-Sand's perfect uniformity—which allows you to standardize your mixes. You save the time and money that would normally be spent changing mixes every time a car of sand is received.

Triple washing, multiple screening and rigid testing before shipment are responsible for the perfect uniformity of each grade of Penn-Sand—a uniformity maintained shipment after shipment after shipment.

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FEF Graduate Work Provides

ADVANCED FOUNDRY

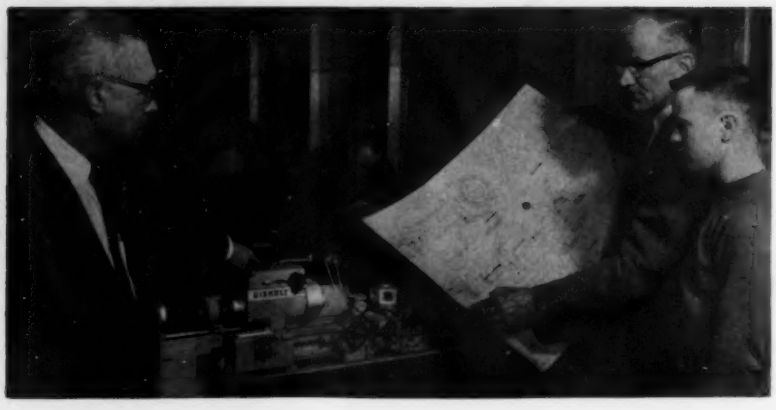
Consulting Arnold Salg, foundry superintendent, Gisholt Machine Co., right, William Shaw looks over finished castings

● SINCE 1947, through the activities of the Foundry Educational Foundation and co-operating universities, a growing number of undergraduate students have been receiving basic training in subjects concerned with metal castings.

Until 1958, the FEF had been able to offer nothing tangible to the student who wished to go into graduate study. In that year, however, the Wheelabrator Corp., Mishawaka, Ind., a charter member of the FEF, decided to commemorate its 50th anniversary with a $100,000 grant to the FEF, the bulk of which is accounted for by 50 fellowships of $1500 each.

William Shaw of Kohler, Wis., is typical of the first group of young

Listening to theory presented at a meeting of the University of Wisconsin Chapter, AFS, by Bradley Booth, secretary of Wisconsin chapter of AFS

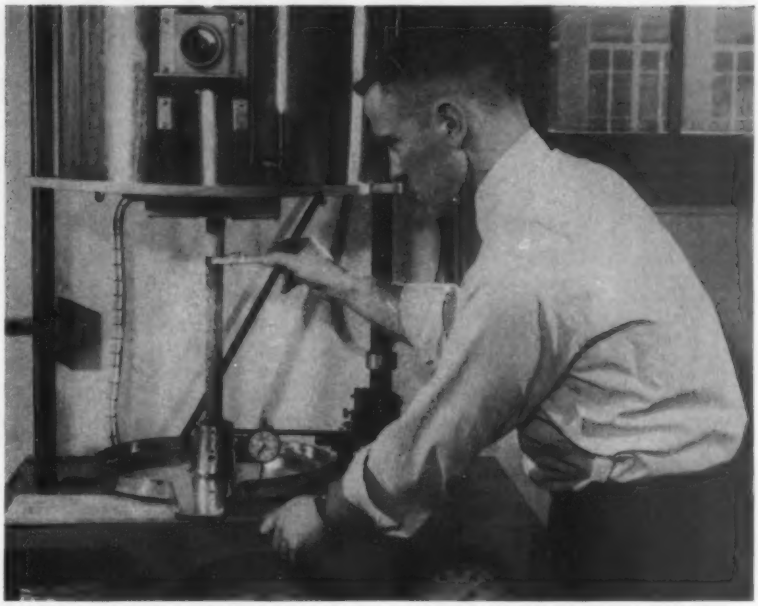


Learning Gisholt Machine Co. work methods. At left is H. Stanley Johnson, vice president, Gisholt; center is Edward Helmke, chief engineer

TRAINING

men to receive graduate study assistance from the FEF. The accompanying views depict his life at the University of Wisconsin, where his work is leading to a master's degree in metallurgical engineering. This presentation illustrates in a small way how the foundry industry can staff itself with well rounded engineers and scientists.

The second group of Wheelabrator Fellowship winners, announced recently, and the schools at which they will study are as follows: Robert G. Liptai, Missouri School of Mines; Ernest J. Poirier, Massachusetts Institute of Technology; Thomas S. Piwonka, Case Institute of Technology; Otto K. Riegger, University of Michigan.

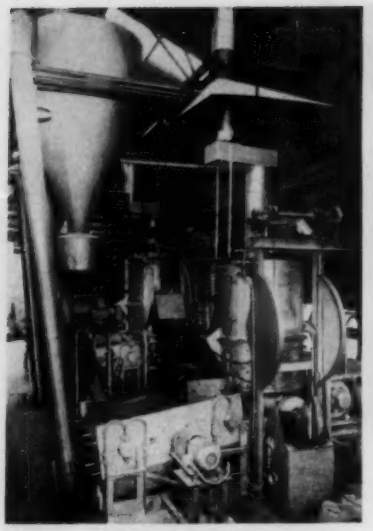


Working in the foundry workshop, University of Wisconsin, on the dilatometer to gather data for use in preparation of his thesis

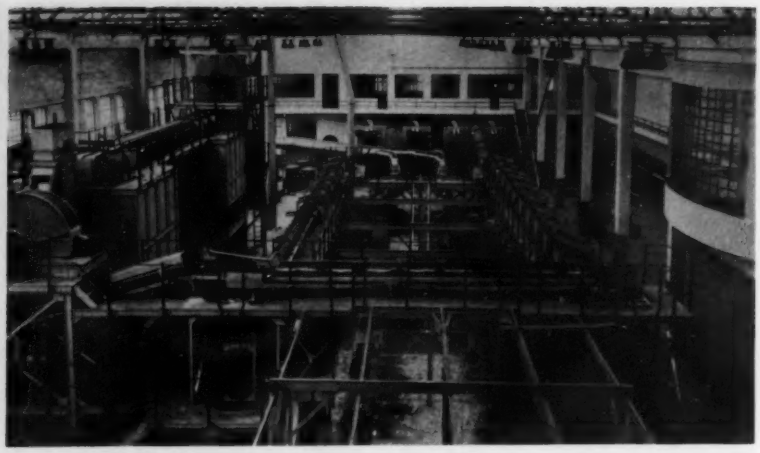
Learning in the classroom by listening attentively while a lecture is delivered

Getting "on-the-job" training in "domestic engineering" as he helps his wife in their apartment

Conferring with E. J. Walsh, left, executive director, FEF, and Prof. Richard W. Heine, University of Wis.



Two shells and coating units made by Fordath Engineering Co. and installed at its works at Brandon Way, West Bromwich



Fully mechanized continuous casting installation designed by Foundry Equipment Ltd., Leighton Buzzard, Bedfordshire, England. It was designed and erected for a firm in Spain which produces sewing machines

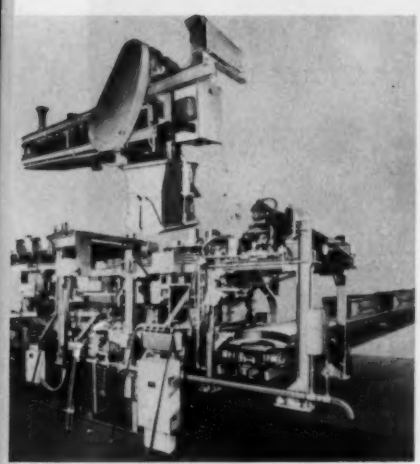
Postwar Changes in

Britain's Foundry Industry

By VINCENT C. FAULKNER
Editor
Foundry Trade Journal
London

● WHEN, some 5000 years ago, a craftsman in Mesopotamia molded and cast a beautiful little statuette of a frog surmounted by a stalk and a lotus flower, he had but a few elementary tools to help him. Last year, to meet the demands of Ford Motor Co. Ltd. at Dagenham, near London, for castings for their lorry and automobile production, £3,500,000 ($9,800,000) was spent with British manufacturers to equip the new foundry.

Between these two events, there has been a gradual—and recently a dynamic—development of plant for the manufacture of castings. It is not always recognized that the manufacture of castings in steel, iron, bronze, brass, aluminum, and magnesium is a basic industry, on the continued existence of which civilization as we know it depends.

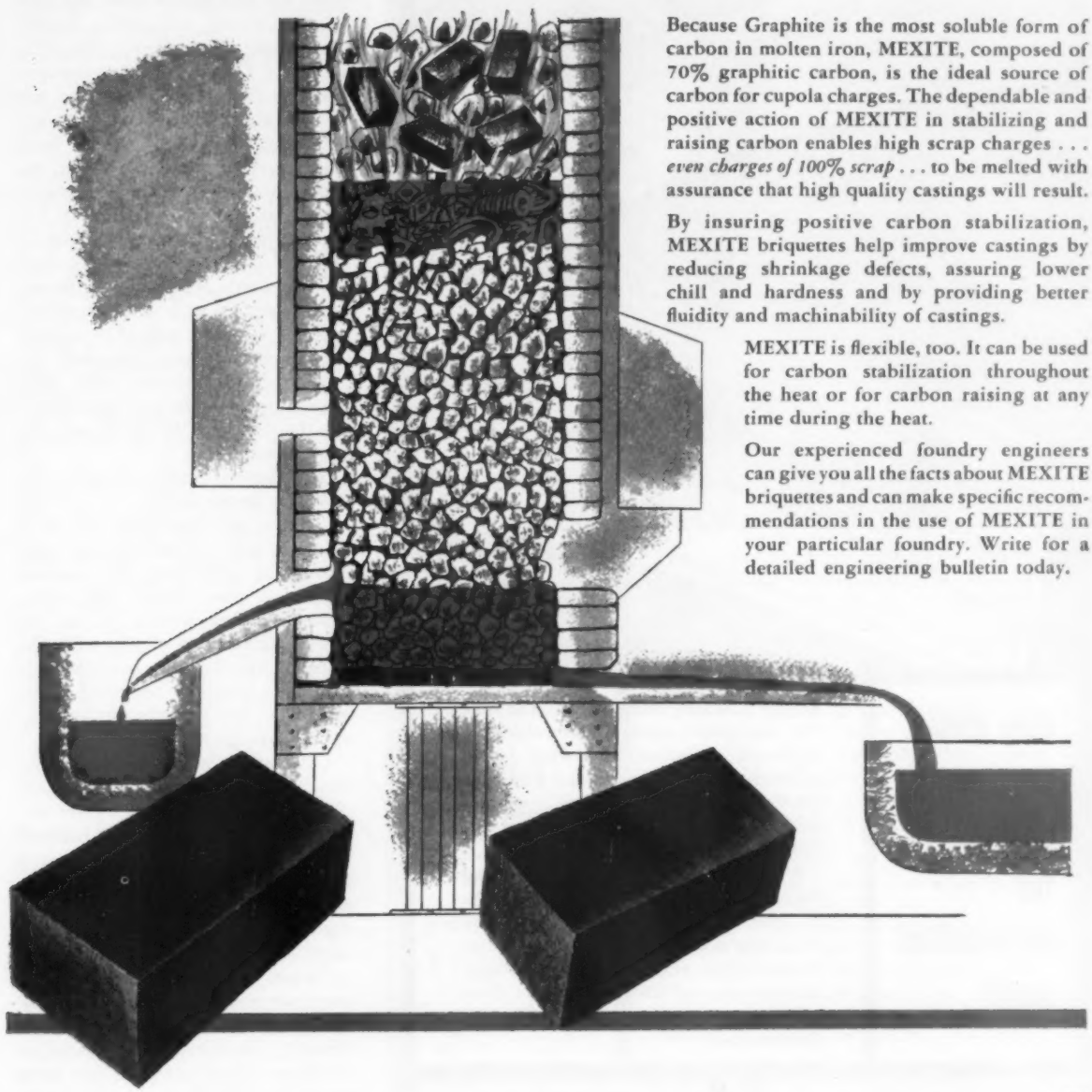


Automatic molding machine is one of pair recently supplied to the Soviet Union. It can produce 240 complete green sand molds per hour and was made by Coleman-Wallwork Co.

New Processes — Thus, if the foundry is basic to all other industries, then equally so is the much smaller industry which makes its tools and provides its raw materials. It was probably World War II which emphasized the great responsibilities of, and the opportunities open to, manufacturers of foundry equipment and supplies. The plant designers co-operated wholeheartedly with the makers of mechanical handling equipment with remarkable results. Before that war, the United Kingdom was importing something of the order of £330,000 ($924,000) worth of foundry equipment each year. Since then, the picture has changed entirely and now it has become an important exporting industry. Exports have been made to the United States, all European countries, and the Far East.

A pleasing feature of this devel-

YOU CAN CHARGE MORE SCRAP IRON AND GET HIGH QUALITY CASTINGS WITH MEXITE® (GRAPHITE BRIQUETTE)



Because Graphite is the most soluble form of carbon in molten iron, MEXITE, composed of 70% graphitic carbon, is the ideal source of carbon for cupola charges. The dependable and positive action of MEXITE in stabilizing and raising carbon enables high scrap charges . . . *even charges of 100% scrap* . . . to be melted with assurance that high quality castings will result.

By insuring positive carbon stabilization, MEXITE briquettes help improve castings by reducing shrinkage defects, assuring lower chill and hardness and by providing better fluidity and machinability of castings.

MEXITE is flexible, too. It can be used for carbon stabilization throughout the heat or for carbon raising at any time during the heat.

Our experienced foundry engineers can give you all the facts about MEXITE briquettes and can make specific recommendations in the use of MEXITE in your particular foundry. Write for a detailed engineering bulletin today.

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THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 14, MICHIGAN

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Circle 651 on Page 53

WHICH CHECK WOULD YOU RATHER WRITE?

How much are you paying for uncontrolled dust?

See for yourself—add up the cost of your lost salvageable material, housekeeping expenses, excess machine wear, intangibles such as community and employee goodwill. Whether your total is moderate or high, Pangborn Dust Control will cost you *less* than uncontrolled dust.

For details on Pangborn's engineering knowledge and experience, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland. *Manufacturers of Dust Control and Blast Cleaning Equipment — Rotoblast® Steel Shot and Grit.*

Pangborn CONTROLS DUST

opment has been the speed at which new equipment has been designed and manufactured to cater to the revolutionary new processes developed since the war. Among these is shell molding and coremaking. The wide range of machines for carrying out this process includes some which make the whole process automatic.

Revival of a Process—A second process—a British invention of 50 years ago and reborn since the war—is known as the carbon-dioxide process or, more simply, the CO_2 method. On the whole, conventional facilities can be used for the process and it is the firms compounding the bond which have made striking progress. After experimenting with pilot equipment, large and expensive machinery has been installed for the production of modified water glass specially suited to foundry applications. Again, in connection with shell molding, equipment costing tens of thousands of pounds has been installed for providing the industry with precoated resin sands and machinery for the founders to carry out the work themselves.

The British foundry supplies industry is based solidly on scientific principles, and hundreds of technologists and technicians are employed in perfecting the various fluxes and core binders they manufacture. This section of the industry collaborates closely with the research associations, and the contributions made to technical gatherings by British scientists is universally recognized.

Catering to Small Firms—Today, one hears much about automation of which there are few better examples than in the mechanized foundry where all the complicated movements have been harnessed to pushbutton control. Only a few concerns have an output of such magnitude as to warrant the installation of such machines, and a search is constantly being made by the equipment industry to provide efficient machinery for smaller foundries. Good progress has been made in providing molding machines, sand-preparing plant, coremaking devices and other labor-saving machines to meet the needs of even the smallest concerns.

The industry has had its own association since 1926—the Foundry

Trades' Equipment and Supplies Association. Since its inception, it has sponsored or supported about seven or eight so-called foundry exhibitions, which are really displays of plant and materials used by that industry.

The Foundry Trades' Equipment and Supplies Association has cooperated closely with the British Cast Iron Research Association and the British Steel Castings Research Association in providing grinding machines having really satisfactory dust-extraction mechanisms. In this field of hygienic engineering, British enterprise plays a leading part, especially in a still later development—the high-velocity, low-volume exhaust system for dust-producing hand tools—which is rapidly entering into the world's markets. The association has also collaborated with the British Standards Institution in establishing the dimensions and other properties of chilled grit used for shotblast cleaning of castings, and for molding boxes.

First Foundry Exhibition—The association has sponsored Britain's first national exhibition devoted solely to the foundry industry. This was held in Birmingham from May 21 to 30, when the city's Bingley Hall housed the biggest concentration of exhibits of foundry equipment and supplies to be assembled as a collective indication of the industry's strides in mechanization, mechanical handling, and modernization generally. Nearly 100 firms specializing in the manufacture and supply of foundry requisites took part.

Plastic Tooling Film Offered By United States Gypsum Co.

United States Gypsum Co. has produced a 16-mm colored film on patternmaking and tooling with epoxy resin plastics. It shows how to produce plastic pattern equipment including matchplates, coreboxes, and cope and drag equipment quickly and economically. Metal forming and checking and inspection applications also are described.

This film is available at no cost from Plastics Engineering Dept. 139, United States Gypsum Co., 300 W. Adams St., Chicago 6, Ill.

ROTOBLAST CUTS CLEANING TIME 42%

Pangborn Rotoblast reduces cleaning time from 12-15 minutes per 2,000 lb. load to 7 minutes at Ingersoll-Rand

At Ingersoll-Rand Co., Painted Post, N.Y., blast cleaning loads weigh 2,000 lbs., include castings up to 300 lbs. each. To handle these loads efficiently, Ingersoll-Rand replaced its old blast cleaning barrel with a new Pangborn Rotoblast Barrel . . . and benefited *three* ways!

Cleaning quality is "incomparably better." Maintenance time and costs have been drastically cut. (For example, wheel vanes previously lasted 12 to 15 blast hours, now last 70 blast hours.) And cleaning time per load has been reduced from 12-15 minutes to only 7 minutes! Cleaning production now exceeds 10,000 lbs. per hour, cutting 7½-hour days to 3 and 4-hour days in the cleaning department.

For full details on how Pangborn Rotoblast can save you money, write: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment—Rotoblast Steel Shot and Grit.*®

Pangborn

Cleans it fast with ROTOBLAST®

Literature for Foundrymen

For More Information Use Reply Card—Page 53

Refractory Products

Large illustrated manual with indexed divisions contains complete information on company's refractory products. Specification charts, data sheets, and consumer price lists are included in the manual.—Davis Firebrick Co., Oak Hill, Ohio.

For More Details Circle No. 407—Page 53

Conveyor and Elevator Belting

"Conveyor and Elevator Belts," an illustrated, four-page brochure, presents specifications and applications for four brands of rubber belting. Weight computation of the belting is explained.—**Home Rubber Co.**, Trenton 5, N. J.

For More Details Circle No. 408—Page 53

Flasks and Jackets

Brochure contains design features of the company's magnesium flasks and cast iron and aluminum jackets. Illustrations are included.—**Fremont Flask Co.**, 1000 Wolfe Ave., Fremont, Ohio.

For More Details Circle No. 409—Page 53

Precision Forming Process

Brochure details Minicast precision forming process—what it is, what it does, and what type of parts can be produced. Basic design information is included.—**Casting Engineers Div., Consolidated Foundries & Mfg. Corp.**, 2323 N. Bosworth Ave., Chicago 14, Ill.

For More Details Circle No. 410—Page 53

Stock Core Machine

Specifications and features of Shell-Truder automatic stock core machine are presented on sheet.—**C & S Products Co.**, 18656 Fitzpatrick Ave., Detroit 28, Mich.

For More Details Circle No. 411—Page 53

Electrometer

Bulletin B-248 describes and illustrates company's Compax pH electrometer. Buffer tablets are also described.—**Coleman Instruments Inc.**, 42 Madison St., Maywood, Ill.

For More Details Circle No. 412—Page 53

Foundry Clays

Pamphlet covers company's bonding, airfloated, and fire clays and shows how production methods assure quality and uniformity.—**Cedar Heights Clay Co.**, 50 Portsmouth Rd., Oak Hill, Ohio.

For More Details Circle No. 413—Page 53

Pneumatic Tubing

Bulletin 1 outlines general characteristics of hydraulic and pneumatic tubing. Included are price list, chemical resistance chart, and complete specification data.—**Synflex Products Div., Samuel Moore & Co.**, Mantua, Ohio.

For More Details Circle No. 414—Page 53

Compressed Air Cleaner

Catalog 459 provides information on Aridifier models for air lines ¾ to 10-in. in diam. It includes informative tables on the use of compressed air, including requirements for various air tools and spraying operations.—**Aridifier Div., Logan Engineering Co.**, 4901 W. Lawrence Ave., Chicago 30, Ill.

For More Details Circle No. 415—Page 53

Surface Pyrometer

Bulletin 0051 presents design features and uses of portable surface pyrometer. Operation principle is explained.—**Atlantic Pyrometers Inc.**, 190 Warburton Ave., Hawthorne, N. J.

For More Details Circle No. 416—Page 53

Truck Driving Instructions

Instructors' manual for truck operators' training program is divided into six stages—theory of operation, good driving practices, details of construction in principal types of trucks, practical operation of the truck, demonstration, and written examination for the driver trainee.—**Automatic Transporation Co.**, 149 W. 87th St., Chicago, Ill.

For More Details Circle No. 417—Page 53

Adjustable-Speed Drive

Bulletin K-250 discusses adjustable-speed and drive control problems. Areas covered include typical applications, methods and types of remote and automatic control, and variable speed bedplate assemblies.—**Cleveland Worm & Gear Co., Speed Variator Div.**, 3300 E. 80th St., Cleveland 4, Ohio.

For More Details Circle No. 418—Page 53

Dust or Mist Collectors

Brochure on dust or mist collectors describes type and number of grinding, buffing, or polishing machines each can service. Detailed descriptions of accessory equipment and illustrations of installing and exhausting procedures are included.—**Aget Mfg. Co.**, Church Street, Adrian, Mich.

For More Details Circle No. 419—Page 53

Safety Signs

More than 400 self-sticking accident prevention signs are described in Catalog 520. Basic-purpose and specific-purpose signs are offered.—**W. H. Brady Co.**, 727 W. Glendale Ave., Milwaukee 9, Wis.

For More Details Circle No. 420—Page 53

Refractories

Vol. 4, No. 2 of *Refractories by Carborundum* contains information on company's refractories, including properties, uses, and recent developments. Bulletin explains what they are, where and when to use them, and how to use them effectively.—**Refractories Div., Carborundum Co.**, Perth Amboy, N. J.

For More Details Circle No. 421—Page 53

Diecasting Machines

Complete line of 17 models of diecasting machines is described in Bulletin CM-100. Eight models are plunger or gooseneck-type machines, and nine are cold-chamber type. Illustrations show features in both types. Specifications are listed.—**Cast-Master, H-P-M. Div., Koehring Co.**, Bedford, Ohio.

For More Details Circle No. 422—Page 53

Nickel Alloys for Castings

"A Quick Guide to the Nickel-Containing Casting Alloys" highlights all casting alloys which contain nickel. Book-

Did You Miss These?

Here is a list of popular literature items offered in recent months:

FOUNDRY FACINGS—Frederic B. Stevens Inc., Detroit 16, Mich., Circle 401, Page 53.

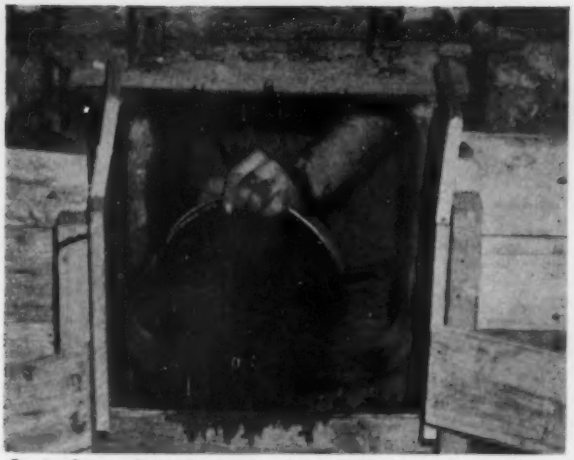
SOLDERING ALUMINUM—Reynolds Metals Co., Richmond 18, Va., Circle 402, Page 53.

CUPOLA MELTING SYSTEM—Compagnie Generale des Conduites d'Eau, Departement Installations Metallurgiques, Liege, Belgium. Circle 403, Page 53.

INVESTMENT CASTING DESIGN—Picco Industries, El Monte, Calif., Circle 404, Page 53.

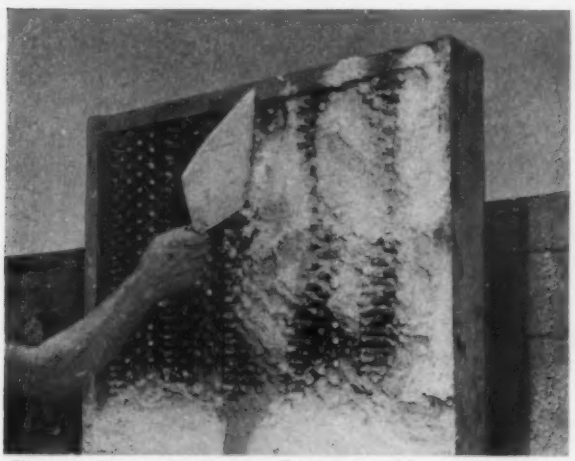
PHENOLIC RESINS (Booklet CDC-358)—General Electric Co., Chemical Materials Dept., Pittsfield, Mass. Circle 405, Page 53.

ALUMINUM PRODUCTS ("Aluminum Mill Products")—Kaiser Aluminum & Chemical Sales Inc., Chicago 11, Ill. Circle 406, Page 53.



Casting furnace linings in place can be speedily accomplished with any B&W Refractory Castable. Here, tough, erosion-resistant B&W Kaocrete-D is cast in a lining that will be ready for service soon after installation.

Gunning B&W Kromight-Gun assures complete penetration of irregular areas. This 3200 F refractory material is excellent for studded open hearth doors and similar metalworking installations.



Slap trowelling can be the most effective way of forming a vertical or overhanging section of lining, provided the castable has an exceptionally adhesive, plastic texture. B&W Kaocrete-B, possessing these properties, is widely used in this type of installation.

Vibrating B&W Kaocrete-32 in place to form electrode rings in an electric furnace. This method of installation provides density and strength, and eliminates laminations, air bubbles and pockets, thus permitting economical, long life.

How B&W refractory castables solve application problems

Installing refractory linings quickly and inexpensively is a major concern of furnace builders and operators. Each of the many different types of metal working furnaces presents its own particular installation problems. To meet these widely differing conditions, B&W offers not just one, but a range of *specialized* refractory castables. Each is *engineered* to provide savings in installation time. *Specialized* B&W Refractory Castables save money by eliminating the need for costly inventories of special shapes. The use of castables speeds up new construction and repair jobs and permits simplified, improved furnace design together with long life—in short, superior performance over a wide range of furnace operating conditions.

B&W Bulletin R-35A gives additional information on versatile B&W refractory castables. Write for copy to The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N. Y.

R621

B&W

THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

B&W Firebrick, Insulating Firebrick, and Refractory Castables, Plastics, Ramming Mixes, Mortars, and Ceramic Fiber.

Circle 654 on Page 53

let reviews each material to help pinpoint alloy with desired properties.—International Nickel Co., 67 Wall St., New York 5, N. Y.

For More Details Circle No. 423—Page 53

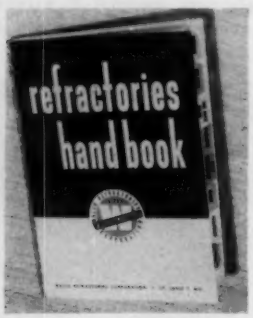
Recorders and Controllers

Strip-chart recorders and recording controllers for measurement of electrical and process variables are described in Bulletin GEA-6887. Included are product photographs, application data, typical control system schematics, specifications, and dimensions.—General Electric Co., Schenectady 5, N. Y.

For More Details Circle No. 424—Page 53

Refractory Products

Handbook has been revised to improve general format and provide a wider presentation of company's refractory prod-



ucts, including a number of new products. Modifications and improvements in plastic anchors are featured, and a more modern and less costly palletizing method for export shipments is detailed.—Walsh Refractories Corp., 101 Ferry St., St. Louis 7, Mo.

For More Details Circle No. 425—Page 53

Cleaning Floors

Booklet F10593 contains charts, lists of cleaning compounds, and descriptions of cleaning methods. It also describes methods of sanitizing, stripping wax and paint, and absorbing liquids.—Oakite Products, Inc., 127B Rector St., New York 6, N. Y.

For More Details Circle No. 426—Page 53

Pencil Grinder

Features and specifications of air-powered pencil grinder are covered in Bulletin 61. List of standard and optional equipment is included.—Rotor Tool Co., 26300 Lakeland Blvd., Cleveland 32, Ohio.

For More Details Circle No. 427—Page 53

Polyphase Motors

Bulletin SDA 105 describes polyphase motors from ½ to 30 hp in frame sizes from 56 to 326U.—Electric Motor Div., Peerless Electric Co., Warren, Ohio.

For More Details Circle No. 428—Page 53

Industrial Gases

Catalog ADC 892 thoroughly covers production and commercial applications

UP TO 360 SHELL MOLDS PER HOUR, bonded with Durez resin, move out from two four-station Link-Belt molding machines. Screened sand for molds flows from storage bins directly into mixer, where it is coated with **Durez 18250** resin. Coated sand goes to a surge bin, then is screw-fed to molding machines.

Take a fast trip through a "push-button" shell-

When foundry-equipment specialists build their *own* shell-molding line, you can expect to see a high order of mechanization.

You're not disappointed when you look in on Link-Belt Company's new Ewart malleable iron foundry in Indianapolis.

Like everything else in this foundry, the shell-bonding resin, *Durez 18250*, has been chosen for its ability to match every requirement of the highly automated process.

The use of powdered resin helps keep sand-coating time to a minimum. Its *fast cure* permits molding machines to work at top capacity. The *high-strength molds* it produces have helped Link-Belt get smooth-surfaced, accurate castings—castings that need very little machining.

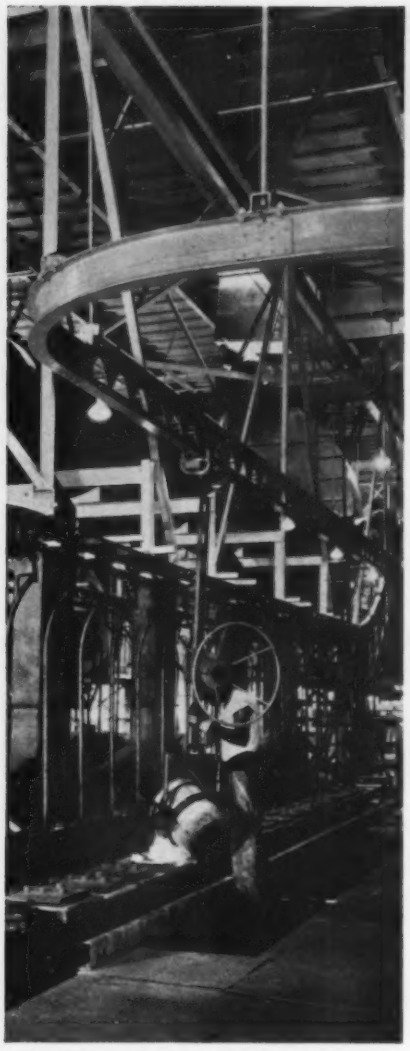
Finally, the mold-to-mold, shift-to-shift *sameness* of this Durez resin gives Link-Belt foundrymen the consistent results that are vital to good productivity.

Where to get help with resin problems

If you too, want to get *all* the benefits of shell molding and coring, have a talk with your Durez sales engineer. He can show you how you get less of *every* shell-molding problem when you work with Durez resins —and more of the accuracy and speed that shell molding gives you.

He's foundry-trained—has assisted many foundrymen with needs like yours. Call him in soon.

MOLDS RIDE A TROLLEY to pouring area. High-speed production requires a high level of uniformity in mold materials. Durez foundry resin meets the exacting specifications.



MEN POUR WHILE ON THE MOVE. Pouring platform travels at same speed as mold conveyor. Three men can pour simultaneously. Strong, uniform molds help keep rejects to a minimum.

molding line

New 32-page "Guide to Shell Molding"

Valuable manual contains recommendations on patterns, materials, mixing, temperatures, lubricants, molds, cores. Written by men who have worked with shell molding for years. Yours free—just write for it.

COOLED CASTINGS AND SAND spill automatically onto shakeout screen. Castings and sprue are conveyed to sorting and spruing apron. Sand goes by oscillating conveyor and bucket elevator to reclamation and storage.

DUREZ PLASTICS DIVISION

1009 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

of all currently available industrial gases. This illustrated, 32-page booklet offers a comprehensive survey of how each gas is made, delivered, and used.—**Air Reduction Sales Co.**, division of Air Reduction Co., 150 E. 42nd St., New York 17, N. Y.

For More Details Circle No. 429—Page 53

Plunging Process

Beginning with a brief review and background of plunging and its advantages in ductile iron production, "Plunging Sil-Mag Alloys" discusses the equipment in-

volved in the plunging process, the process itself, and the alloys used.—**Ohio Ferro-Alloys Corp.**, Canton 9, Ohio.

For More Details Circle No. 430—Page 53

Material Handling Equipment

Five bulletins present information on company's material handling equipment. BU-600 gives data on 3000-lb capacity lift truck; BU-498 covers engineering and design features of different trucks; BU-497 is "Accessories and Optional Equipment"; BU-499 pictorially covers allied equipment for the trucks; and BU-465-A explains power shift torque converter drive for lift trucks.—**Engine-Material Handling Div., Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

For More Details Circle No. 431—Page 53

Incentive Plan

Booklet explains the Rucker Plan for boosting productivity and improving labor co-operation and compensation. Basic principles are outlined and case histories described.—**The Eddy-Rucker-Nickels Co.**, 4 Brattle St., Cambridge 38, Mass.

For More Details Circle No. 432—Page 53

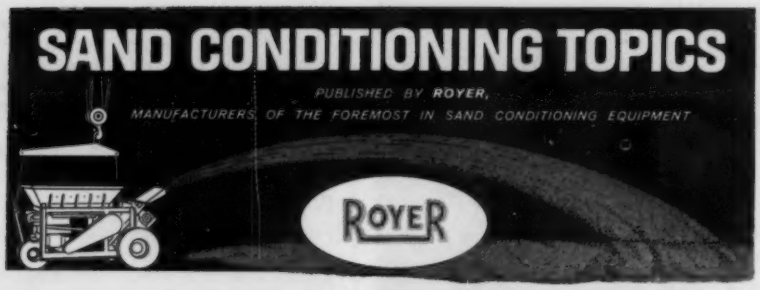
Wire Rope Blocks

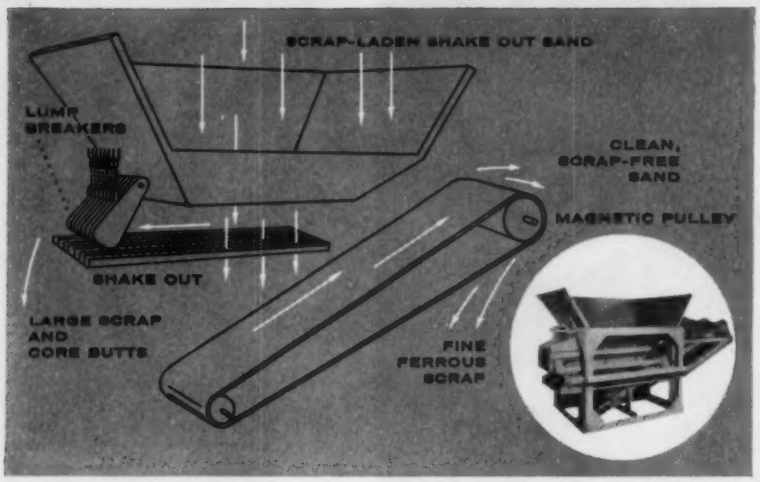
Catalog I contains specifications including tonnage capacities and recommended wire rope sizes for Durolite blocks and sheaves. Important features are described.—**Sauerman Bros., Inc.**, Dept. FYC, 620 S. 28th Ave., Bellwood, Ill.

For More Details Circle No. 433—Page 53

Titanium

Booklet on titanium and titanium alloys includes sections on titanium's high-temperature performance, corrosion resistance, erosion resistance, properties,





Sand Contamination Drains Your Profits

Periodic business recessions in the foundry industry point up the need to eliminate waste and excessive hand labor—or sacrifice profits. In one area of foundry operation—sand contamination — important strides have been made in stopping the profit drainage.

Tramp iron damage usually occurs at the muller, conveyor belts, aerator or patterns. Patterns faced with contaminated sand produce poor casting finishes and high scrap loss. Probably the most efficient and economical way to remove contamination and produce clean sand is with a Royer Scrap Control Unit.

Referring to the drawing, shake out sand from the molding floor is dumped by front-end loader into the receiving hopper. Large scrap is riddled out by the Shake-Out and discharged at convenient wheelbarrow height for collection and removal.

Ferrous scrap small enough to pass through the grid openings of the Shake-Out is separated from the sand by a magnetic pulley at the upper end of the conveyor belt. Depending upon the degree of mechanization you employ, clean sand discharge may be made to a skip hoist feeding a muller, conveyor belt, or into the hopper of a Stationary Royer Separator and Blender for cooling, aeration and blending. We recommend discharge onto a heap for transporting by front-end loader to a Portable Royer Separator and Blender at the molding station for cooling, aerating and fluffing.

If tramp iron is the cause of any of your profit loss, we invite you to discuss your problem with the foundry-wise Royer agent serving your territory. He'll explain how a Royer Scrap Control Unit can pay for itself in less than two years, stop your profit drainage and improve the quality of your castings.

Your first step in stopping profit drainage caused by sand contamination is to mail the coupon for our latest Scrap Control Bulletin. We'll send it without obligation—plus the name of the agent who serves you.

ROYER FOUNDRY & MACHINE CO.

ROYER 159 PRINGLE STREET KINGSTON, PENNA.

Sand Contamination is cutting into our profits. Please rush me your Scrap Control Bulletin.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

metallurgy, machining, welding, and testing. A list of alloys and mill shapes available is included.—Mallory-Sharon Metals Corp., Niles, Ohio.

For More Details Circle No. 434—Page 53

Olivine Sand Cores

Case history data sheet describes use of oil-bonded olivine sand cores in carbon steel—Northwest Olivine Co., 922 Seaboard Bldg., Seattle 1, Wash.

For More Details Circle No. 435—Page 53

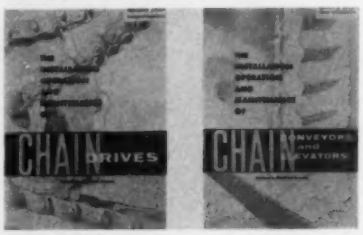
Respirator-Goggle

Brochure describes respirator-goggle combination and 13 filter units which can be interchanged on the basic facepieces.—Safety Products Div., American Optical Co., Southbridge, Mass.

For More Details Circle No. 436—Page 53

Chain Drives and Conveyors

Handbooks outline installation, operation and maintenance procedures for



chain drives in Bulletin 59126 and chain conveyors and elevators in Bulletin 59127. —Chain Belt Co., Milwaukee 1, Wis.

For More Details Circle No. 437—Page 53

Supplemental Resin

Technical Bulletin F-3-Ra describes a supplemental resin recently added to series of powdered phenolic shell molding foundry resins. A list of suggestions for efficient use is included.—Reichhold Chemicals Inc., RCI Building, White Plains, N. Y.

For More Details Circle No. 438—Page 53

Air Hoist

Bulletin describes and illustrates company's air hoist. Complete specification charts and list of accessories are included.—Coffing Hoist Div., Duff-Norton Co., 800 Walter St., Danville, Ill.

For More Details Circle No. 439—Page 53

Carbon Welding Products

Illustrated manual describes in detail how to use carbon plate, rod, and paste to speed up weld repairs.—Arcair Co., Box 431, Lancaster, Ohio.

For More Details Circle No. 440—Page 53

Fork Truck

Brochure describes four-wheel drive tractor. Capacities, specifications, and diagram of features are included.—Kwik-Mix Co., Port Washington, Wis.

For More Details Circle No. 441—Page 53

A. P. Green
REFRACTORY
PRODUCTS

CUPOLA REFRACTORIES

Photograph courtesy of Whiting Corporation

DESIGNED

..to meet your specific requirements for maximum service

A. P. Green has a complete line of high quality refractories for every zone of cupola service. For top efficiency and economy tailored to your particular cupola requirements — A. P. Green manufactures cupola blocks, firebrick, fire clay, high temperature bonding mortars, plastic refractories (super duty, high alumina and graphite-type), breast brick, slag-hole blocks, high strength castable refractories, and special siliceous mixes for gun application or for ramming.

When your A. P. Green representative recommends a particular type of lining, you're sure of the finest refractories modern research can develop . . . specifically designed to give you maximum service at lowest cost.

For specific recommendations, contact your local A. P. Green distributor . . . he's listed in the yellow pages of your telephone directory . . . or write

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REFRACTORY
PRODUCTS

A. P. GREEN FIRE BRICK COMPANY

Mexico, Missouri, U.S.A.

PLANTS: Mexico, Mo.—Woodbridge, N. J.—Sulphur Springs, Texas—Jackson, Oak Hill, South Webster, Ohio—Philadelphia, Climax, Pa.—Troy, Idaho—Pueblo, Colo.—Macon, Ga.
IN CANADA: A. P. Green Fire Brick Co., Ltd., Toronto 15, Ontario

Circle 657 on Page 53

Around the Country

NEWS REPORTS FROM

Chicago . . . Philadelphia . . . Pittsburgh . . . Cleveland

Philadelphia—With the vacation season about over, an improvement in casting demand is anticipated. However, business this summer has held up fairly well—despite the steel strike which cast a shadow over metalworking activity generally.

Light and medium work continues to account for most activity at gray iron job shops, with business in heavy lines still lagging, as has been the case through most of the year. Foundries specializing in machine tool work have been having rough going. In few cases have they been able to get operations up to more than four days a week. Their backlogs have been small, in contrast to six to eight weeks at some shops on light work.

Steel foundries have been particularly affected by the lack of heavy industrial work. It is doubtful if they have averaged more than 55-60 per cent over recent weeks (not taking into account possible down-time for mass vacations).

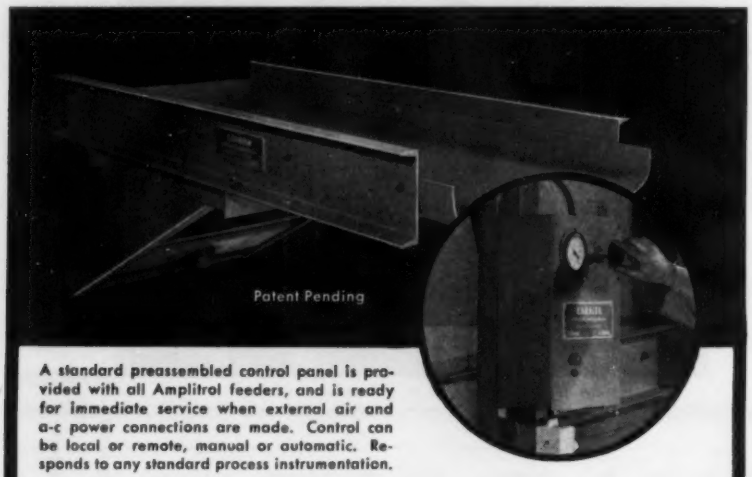
Malleable shops have been able to sustain operations fairly well at around five days a week. There is still a brisk demand for valves and fittings and small hardware among other items.

Nonferrous casting producers report business spotty, particularly in the red metals. However, all are looking forward to a pickup this fall.

Raw material supply is adequate. Notwithstanding the steel strike, there has been no shortage of pig iron, although the ferrous shops have been buying scrap on a heavier scale than expected because of a possible scarcity of iron later.

Chicago—The Illinois Manufacturers' Association is spearheading the protests of industry against the proposed comprehensive rezoning amendment for Cook County unincorporated areas, charging that it is a serious threat to the county's industrial development.

IMA says the amendment, which was proposed by the Cook County Board of Commissioners May 25, would subject industries to harassment for alleged violations of noise, smoke, odor, and other standards; payment of heavy fines; burdensome expenditures for reconstruction; necessity for relocation of plants; need for abandonment of plans for expansion; and restriction from con-



A standard preassembled control panel is provided with all Amplitrol feeders, and is ready for immediate service when external air and a-c power connections are made. Control can be local or remote, manual or automatic. Responds to any standard process instrumentation.

Now! A Mechanical Vibrating Feeder With Variable, Stepless Control

The exclusive Carrier Natural-Frequency drive, and a unique new amplitude control system—these two features of the new Carrier Amplitrol feeder give you benefits found in *no other vibrating feeder*, electromagnetic or mechanical.

LESS DAMPING. . . Amplitrol feeders increase vibrating stroke *automatically* when headload is increased. This allows you to use larger bin openings . . . bigger headloads . . . and to discharge bigger capacities of almost any material.

FULL-RANGE CONTROL . . . A new, highly simplified pneumatic system allows accurate, full-range stroke control. The heavy-duty air springs respond *immediately* to a pneumatic signal from a standard 0-80 psi air pressure valve. No lag.

LESS MAINTENANCE . . . Amplitrol feeders have no chains or v-belts . . . no large revolving weights or bearings . . . no auxiliary electrical parts . . . no gears or guards . . . NEW AMPLITROL FEEDERS ARE JUST THAT SIMPLE.

Send for new 12-page bulletin describing all Amplitrol benefits in detail. Carrier Conveyor Corporation, 224-A North Jackson Street, Louisville, Ky.

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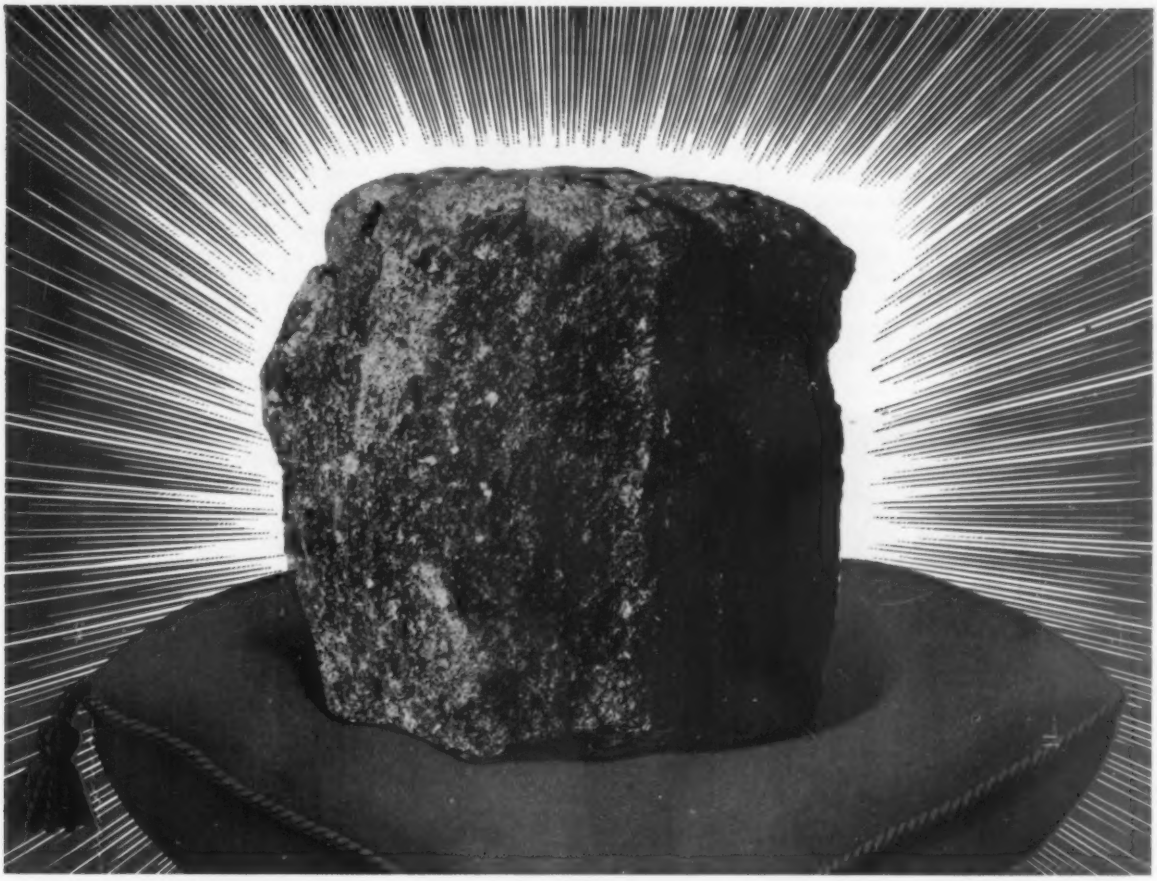
-NATURAL-FREQUENCY-
VIBRATING EQUIPMENT
Engineering Specialists in Vibrating Equipment

CONVEY ● FEED
DEWATER ● SCREEN
COOL ● AGGLOMERATE
DRY ● SCALP ● COAT
DISTRIBUTE ● ELEVATE

Circle 658 on Page 53



Valuable asset: QUALITY

QUALITY—uniform quality ton after ton after ton—is one of the most important assets you can have in the coke you buy.

At Semet-Solvay, coke quality begins at the mine, where we sample every ton of coal, checking for impurities and measuring the coking qualities. At our coke plants, daily tests in sole-heated furnaces and giant test ovens detect and correct variations that might impair coke quality. Production samples are tested daily for uniformity, strength and proper chemical analysis.

Buying foundry coke from Semet-Solvay offers you other advantages, too: Four strategically located plants for fast, dependable service... five different sizes of coke to meet individual cupola and melting requirements ... the services of metallurgical experts to assist you on foundry problems.

If you are not already using Semet-Solvay foundry coke, why not find out now how it can help you obtain a hotter, cleaner, faster cupola operation? Just contact your nearest Semet-Solvay office or write directly to us for complete details.

Sampling coal at the mine—one step in Semet-Solvay's quality-control program to assure you of better melting coke.

Allied Chemical

Yours for better melting...

SEMET-SOLVAY DIVISION

Dept. 555-BH, 40 Rector Street, New York 6, N.Y.

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Circle 659 on Page 53

structing plants on previously purchased sites.

For instance, under the proposed ordinance, light industry would be permitted to emit smoke not to exceed 10 smoke units, medium industries 15 units and heavy industries 25 units. Los Angeles permits 120 units, St. Louis and Pittsburgh between 80 and 100 units, and Chicago 76 units for all types of units.

Under the proposed Cook County plan, "performance standards" take the place of the more traditional "use lists" found in zoning ordinances throughout the country. This procedure is questioned. It is stated that the proposed county zoning amendment is in many respects identical to a like endeavor in Chicago, and in most respects, such as smoke control, is even more restrictive on industry.

It is pointed out that the Chicago ordinance has not been in effect long enough to determine whether performance standards will work. IMA feels they will not work in Chicago, nor in Cook County.

Public hearings on the proposed ordinance are continuing, with attacks and criticism running strong.

* * *

In September, Crane Co. is transferring from Chicago to its Chattanooga, Tenn., plant certain of its steel valve manufacturing operations. Affected will be 300 to 400 workers, although it is likely that about half this number will be absorbed in other Chicago operations. It is understood the casting and forging of the steel valves will continue at the Chicago works. The Chattanooga plant has been partially idle since last December when Crane ceased boiler and radiator making operations there.

Pittsburgh—Because of the steel strike, foundries that depend on the mills for most of their business have had to curtail operations drastically. Shops whose markets are more diversified are doing relatively well, although new orders are off seasonally. Those that supply the automotive, construction, farm machinery, and heating and plumbing industries are enjoying continued prosperity.

Foundry suppliers had a good first half. Sales of one firm jumped 20 per cent ahead of 1958 figures for six months. If it hadn't been for the steel strike, current business would probably be as good as the first quarter's. Since the start of the walkout, new orders have fallen off about 50 per cent. Foundries that serve the automotive and agricultural implement industries are showing a lot of interest in automatic molding machines and accessories.

A major labor dispute was settled temporarily when Specialty Steel Products Inc., Braddock, Pa., agreed to arbitrate its differences with union leaders at a firm it recently acquired. After purchasing the American Steel Foundries plant at Verona, Pa., on Apr. 5, the new owners attempted to consolidate their operations at Verona. When they took possession of the property on June 1, they planned to run it with workers who had previously been employed at Braddock (members of the International Association of Molders and Foundry Work-

NEW U. S. "SKLENAR"
MELTING FURNACE
5 of the BIG
REASONS WHY
For more rugged construction, faster melting, built-in economy of operation and lower maintenance costs, nothing surpasses the revolutionary new U. S. "Sklenar" Reverberatory Melting Furnace. It's tomorrow's method of melting metals . . . today! Available in sizes ranging from 500 to 2,000 lbs.—iron, brass, and bronze (⅓ these capacities for aluminum melting).
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U.S. SKLENAR
U. S. SMELTING FURNACE CO.

ers). But former employees of American Steel Foundries, represented by Local 1156 of the United Steelworkers, had other ideas. Insisting that Braddock people had no right to Verona jobs, they kept the Molders out. Pickets milled around the plant, blocking the gates, despite a Federal court's order prohibiting such activity.

On July 28, hostilities were suspended. Special Steel agreed to hire members of both unions on a one-for-one basis. Each union appointed an arbitrator, and they in turn selected a third. Eventually the three will decide by majority vote which union should represent the Verona workers.

Cleveland— Eleven Cleveland area youths were among the junior and senior high school students who won 671 cash prizes in Ford Motor Co.'s 13th annual Industrial Arts Awards competition.

One of the Cleveland winners was in the competition's patternmaking division. Carmen R. Sopuch, a student at West Technical High School, received honorable mention and a $20 prize for his entry of cope and drag patterns and coreboxes for a pump body.

The first public showing of outstanding achievement award (highest prize in the competition) and first prize entries was held in Cleveland Aug. 3-8. More than 45,000 students in the United States, its territories, and Canada entered the competition. Winners of the 32 outstanding achievement awards and their instructors will be guests of Ford for a three-day visit in Dearborn, Mich., Oct. 1-3.

Top three national winners in the patternmaking division are: First prize, $100, Ronald Otto, Boys Technical High School, Milwaukee, cope and drag patterns and coreboxes for a steam engine valve chest. His teacher is H. E. Ohly Jr. Second, $80, Martin H. Krauske of the same school, wood patterns and coreboxes for an H_2 compressor base cover. Third, $60, Robert Riccomi, J. Sterling Morton High School & Junior College, Cicero, Ill., patterns and coreboxes for a drill press base. His teacher is Paul R. Rohe.

Molding division: First prize, $100, David Eby, Lane Technical High School, Chicago, aluminum bevel gear casting. His teacher is

say "when"!

with MARSHALL

ENCLOSED-TIP THERMOCOUPLES

...for strong, dense, uniform castings from every melt!

Reduce scrap rejects, misruns, cold-shuts ... achieve consistently high quality castings! Marshall Enclosed-Tip Thermocouples indicate instantly and accurately "when" to pour brass, bronze, aluminum, or magnesium melts. Frequent, regular, exact temperature readings help avoid shrinkage porosity, gas porosity, dross ... produce better casting finishes ... control aluminum grain size.

Dependable, easy-to-use Marshall Thermocouples *take interior temperatures deep within the melt.* Tip can be stirred to speed reading, giving *true temperature in about 20 seconds.* Pyrometer always indicates *steady, accurate reading.* Thermocouple wire can't become contaminated from melt or short-circuited by slag. Tip withstands scores of immersions before replacement is necessary. Mail coupon for catalog today!

L. H. MARSHALL CO.

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Furnace Type (above) ... lengths up to 10 ft., for use with Stationary Pyrometer.
Ladle Type (left) ... for use with Portable Pyrometer.

L. H. MARSHALL CO., 270 W. LANE AVE., COLUMBUS 2, OHIO

Please rush Catalog which fully describes Marshall Enclosed-Tip Thermocouples!

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INGOT MOLDS

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FOUNDRYMEN...
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You'll find it pays to standardize on Acme melting pots and ingot molds. They reduce down time and replacement costs because they're cast from a special iron formula that combines strength with high temperature resistance. They improve quality and reduce rejects, too, because they're designed for even heat distribution without hot spots. If you melt any non-ferrous metals, take advantage of our more than 30 years' experience in this field. It's your assurance of consistent high quality in Acme melting pots and ingot molds . . . designed *by* foundrymen, *for* foundrymen.

Quick delivery anywhere in the United States. Write for size list showing 40 standard sizes.

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L. Woodruff. Second, $80, Daniel Gesiakowski, Chicago Vocational High School, Chicago, cast iron anchor. His teacher is Willard Newton. Third, $60, Joseph L. Dalton, Murrell Dobbins Vocational-Technical High School, Philadelphia, cast aluminum fan blade. Edward Saks is the teacher.

A first prize and an outstanding achievement award were won by Ronald Ray Underwood, Stonewall Jackson High School, Charleston, W. Va., for a set of machined permanent molds and aluminum castings made in them for a one-cylinder engine. These awards were given in the machine construction section of the machine shop division.

The Industrial Arts Awards program is an annual competition open to any boy or girl enrolled in vocational or industrial arts courses offered by public, private, or parochial schools in the United States, its territories, and Canada. Students must be in grades 7 through 12 and under 21 years old. No entry fee is required.

All entries fall into 14 divisions, including one general or open division for entries not covered by regular classifications. Divisions include patternmaking and molding, machine shop, wrought metal, woodworking, plastics, electrical, mechanical drawing, architectural drawing, graphic arts, leathercraft, jewelry, ceramics, models, and the open division. Entries in each classification are judged in groups according to the grade level of the student.

The 1960 competition is open now and entries will be judged at Dearborn next June 25. Complete information may be obtained from William A. Harper, Industrial Arts Awards, Ford Motor Co., The American Road, Dearborn, Mich.

LET'S LOOK at

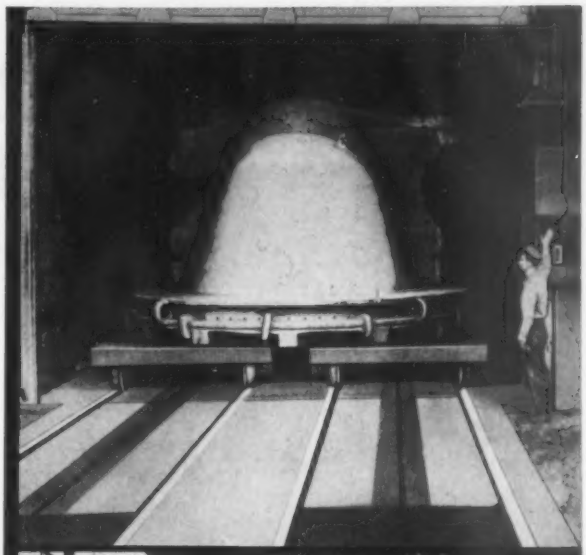
OVENS for every baking requirement

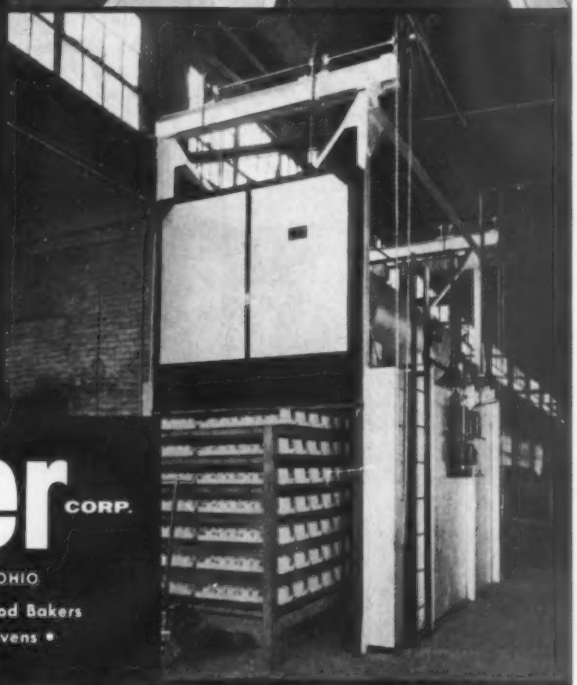
OVENS that will be faster and less expensive to operate

OVENS that are designed to best fit your operation

Carl Mayer designs and manufactures all types of ovens as well as "specials" to meet unusual operating conditions. Most incorporate the Carl Mayer recirculating heating system with sealed combustion chamber that keeps gases from prematurely escaping into the load area. Cores and molds are baked evenly with no burning. Temperatures are always under control.

Write for Bulletin 53-CM





TOP RIGHT—This large car type mold oven is installed at Pittsburgh Steel Foundry. Its special triple slotted panel construction reduces heat loss 1/3. Fuel savings up to 50% over old conventional methods are possible. Drying time is often cut in half and temperatures are uniformly controlled.

MIDDLE RIGHT—This rack type core baking oven is at the Fremont Foundry Co., Fremont, Ohio. It is equipped with a recirculating combination gas-oil fired heating system.

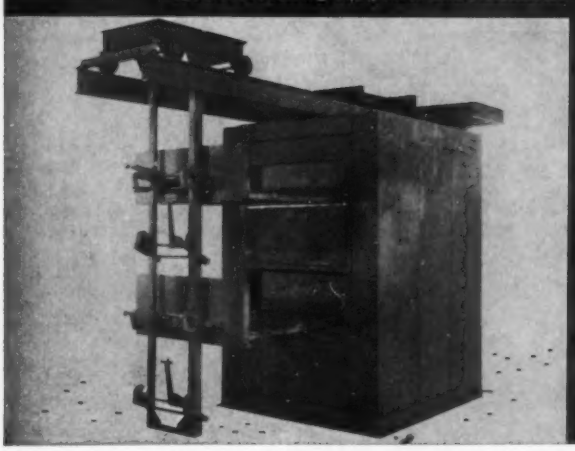
BOTTOM RIGHT—Vertical Core Oven (unloading position) at A. C. Williams Company, Ravenna, Ohio. This oven is 11'-0" wide x 11'-0" deep x 45'-0" high.

BELOW—Our standard rolling drawer type core baking oven. The heating equipment (not shown) may be mounted on floor beside unit or on the roof. Particularly adaptable to brass and aluminum foundries.

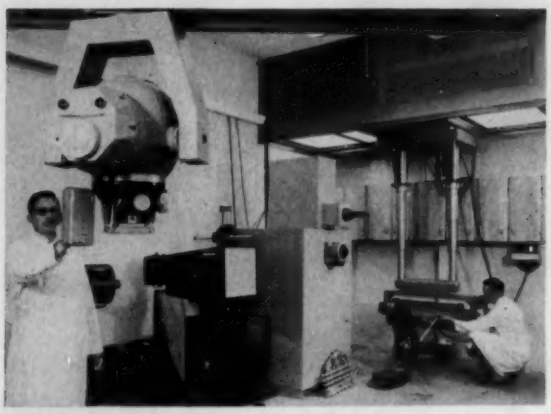
THE **carl mayer** CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories

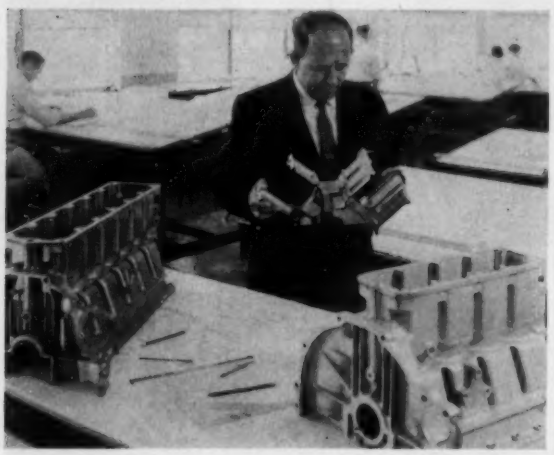


News Views

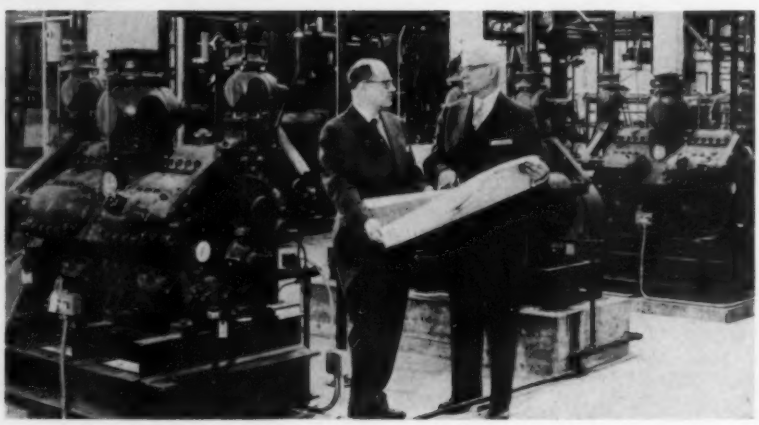


RADIOGRAPHY LAB: Technician, left, checks the radiation level near a Cobalt 60 unit in laboratory of new Picker Research Center, Cleveland. His associate sets up a shot with a 200-kilovolt x-ray machine

ALLOY ROLLS: Rolls for continuous steel strip annealing line are centrifugally cast of a 25 chrome-12 nickel-type heat-resistant alloy. Produced by National Alloy Div., Blaw-Knox Co., Blawnox, Pa., the rolls are 18 in. in diam and 55 in. wide. Minimum finish of face is 32 mu in.



DIECAST ENGINE BLOCK: Alfred F. Bauer, chief engineer and assistant general manager, Doehler-Jarvis Div., National Lead Co., New York, examines a section of a V-8 automobile engine block. Mr. Bauer has been awarded a patent on a diecast aluminum V-8 engine block

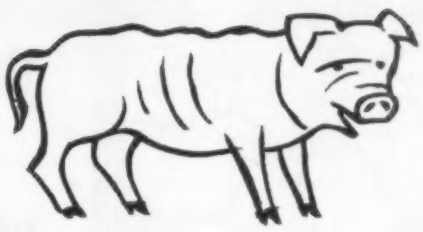


HEAT PUMP: Frank Flick, president, Flick-Reedy Corp., Bensenville, Ill., left, and Roy C. Ingersoll, chairman, Borg-Warner Corp., Chicago, inspect what is believed to be the world's largest air-source heat pump installation. It was installed by York Div., Borg-Warner, in Flick-Reedy's new 220,000-sq-ft manufacturing plant and office. Divisions of Flick-Reedy include Miller Fluid Power Div. and Tru-Seal Div.

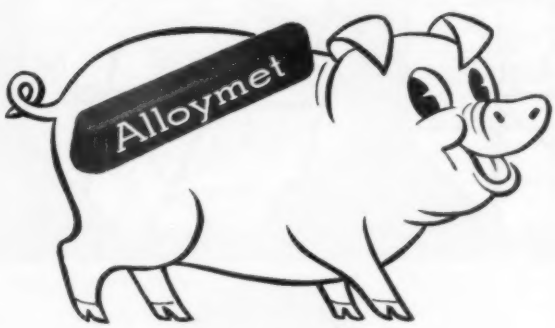
Story of 3 pigs . . . or:

how to pick the best breed of alloy pig for your heats

1. This is "Lardy" Pig. Not a good buy because "Lardy's" often stuffed with unknowns. His type has been the ruination of many a heat.



2. This is "Skinny" Pig. Trouble with "Skinny" is there's not enough of the right stuff in him. When you need a certain alloy analysis, he can't produce it.



3. This is ALLOYMET Pig. Here's the breed to buy! No doubt about the quality of these pigs.

Each ALLOYMET litter is shipped with a notarized laboratory analysis. Using either the 50 lb. ALLOYMET pigs or new 10 lb. "3-in-1" piglets (Ni-Cr-Mo), accuracy of charge additions is assured, resulting in heats that consistently meet specifications. Whatever your nickel base alloy needs may be, investigate the ALLOYMET line.

Send us your inquiry today.

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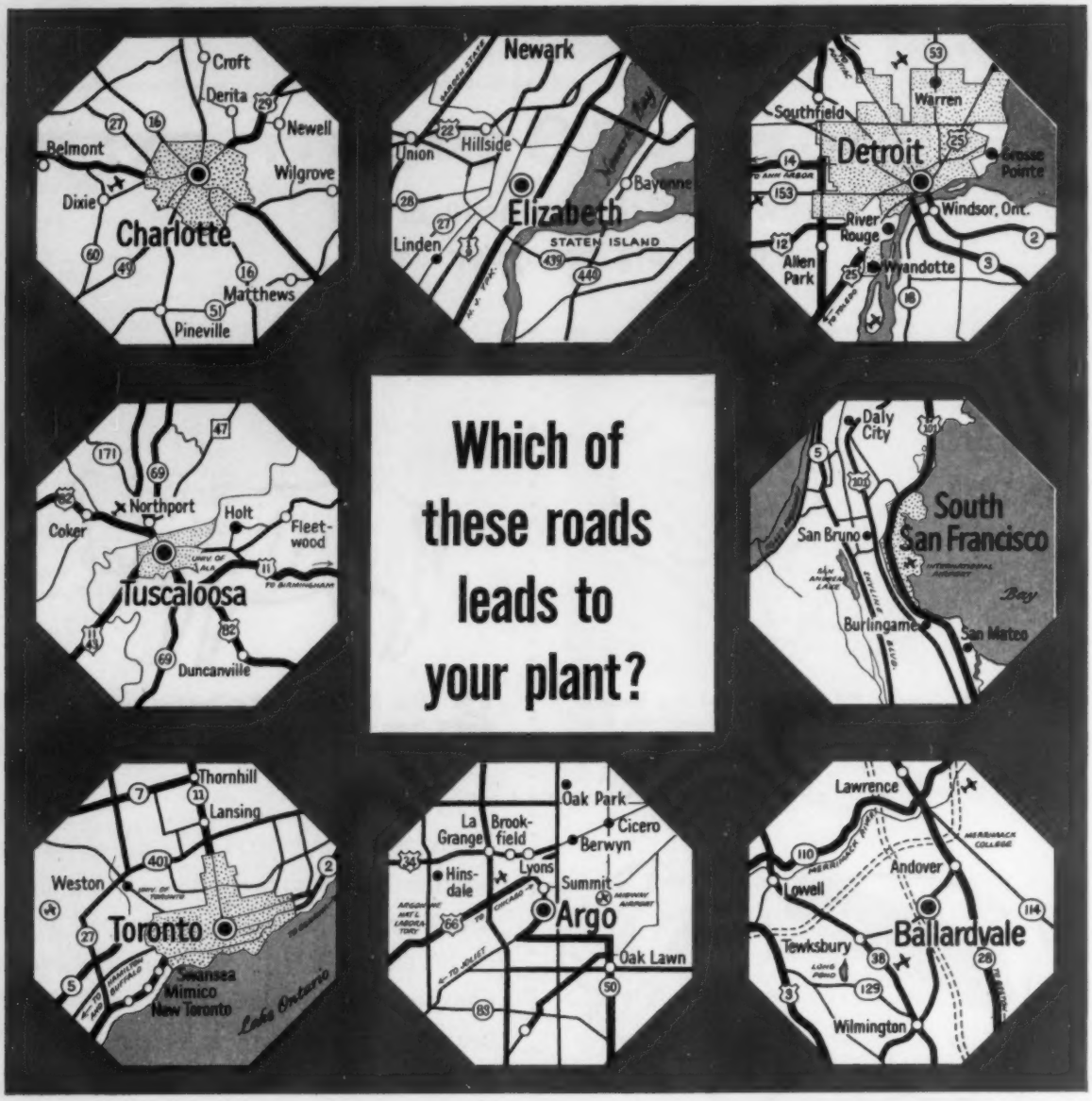
2333 ROCKINGHAM ROAD
DAVENPORT, IOWA

World's largest producer of secondary nickel alloys

Circle 664 on Page 53



Get fast delivery of quality foundry binders from RCI

Is fast, dependable delivery of quality foundry binders important to your production? Reichhold now ships from eight strategically located plants and/or bulk storage points — more than any other producer. The plants are located at: Charlotte, N. C.; Elizabeth, N. J.; Detroit, Mich.; Tuscaloosa, Ala.; So. San Francisco, Calif.; Ballardvale, Mass.; Toronto, Ont. (Reichhold Chemicals, [Canada] Ltd.); bulk storage facilities at: Argo, Ill.

Equally important, Reichhold's experience in the foundry resin field is an assurance that RCI phenolics and amino-aldehydes can satisfy any of your core sand mixture requirements.

Why not contact your Reichhold representative for more information on RCI foundry products.

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N. Y.

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Creative Chemistry... Your Partner in Progress

RCI

FOUNDRY PRODUCTS

FOUNDREZ — Synthetic Resin Binders
coRCIment — Core Oils
COROVIT — Self-curing Binders

Men of Industry

FRED HODGSON
. . . chief product engineer

LYNN D. McDOUGALL
. . . joins Decatur Casting Co.

MANUEL TAMA

MELVIN A. RANEY
. . . vice presidents, Ajax divisions

Fred Hodgson has been named chief product engineer, Foundry Div., Eaton Mfg. Co., Vassar, Mich. He joined the company in 1954 as a product engineer, following graduation from Michigan State University as a Foundry Educational Foundation student. He has served on the Educational Committee of the Saginaw Valley Chapter of the AFS.

Lynn D. McDougall has been named assistant resident manager, Decatur Casting Co., Decatur, Ind. He was formerly with Cooper-Bessemer Corp. at the Mount Vernon, Ohio, and Grove City, Pa., plants.

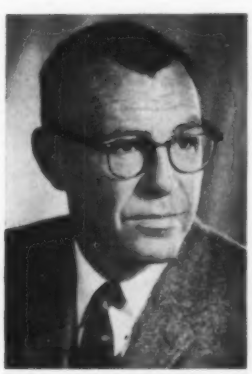
Gordon W. Johnson has been named director of research, James B. Clow & Sons Inc., Chicago, with headquarters at the company research facilities in Coshocton, Ohio. Recently he was assistant director of the Malleable Research and Development Foundation, Granville, Ohio.

Manuel Tama has been named vice president in charge of Ajax Engineering Div., Trenton, N. J. He was president of the former Ajax Engineering Corp. **Melvin A. Raney** has been appointed vice president in charge of Ajax Electrothermic Div., Trenton, N. J. He was in charge of manufacturing, Taylor-Winfield Corp., Warren, Ohio. The two Ajax companies are divisions of Ajax Magnethermic Corp., Youngstown, Ohio.

Robert A. Barr has been appointed general manager, Refractories Div., Babcock & Wilcox Co., New York. Mr. Barr formerly was assistant general manager, Refractories Div., Carborundum Co., Niagara Falls, N. Y.

Murray T. Stewart has joined International Nickel Co. Research Laboratory, Bayonne, N. J., as a member of the special high-temperature alloys section, where he will engage in development of nickel alloys. Previously he was with the Mines Branch, Canadian Department of Mines and Technical Surveys, Ottawa, Ont., and recently with Canadian Steel Improvement Ltd., Toronto, Ont., as chief metallurgist.

George Vingas, recently appointed foundry research engineer, Magnet Cove Barium Corp., Houston, has been assigned to the Magcobar



GORDON W. JOHNSON
. . . Clow research head

ROBERT A. BARR
. . . made general manager

MURRAY T. STEWART
. . . Inco research

GEORGE VINGAS
. . . Magcobar research

CARL G. MATTSON
. . . heads Oregon Chapter

RONALD K. MEYERS
. . . Delhi Foundry Sand Sales

CHESTER DOERR

ELMER DOERR
. . . Frederic B. Stevens sales changes

Foundry Div. headquarters, Des Plaines, Ill. In his new assignment, Mr. Vingas will help formulate sand research projects.

Carl G. Mattson, elected chairman of the Oregon Chapter of the American Foundrymen's Society for 1959-60, since 1947 has been vice president, Dependable Pattern Works, Portland, Oreg., and recently became secretary-treasurer, Dependable Shell Core Machine Inc., there. Mr. Mattson was vice chairman of the chapter last year.

L. G. Crowley, former manager, Milwaukee district, Welding Products Div., A. O. Smith Corp., Milwaukee, has been named southern regional manager with headquarters in Memphis, Tenn. **A. R. Schneller** succeeds Mr. Crowley as manager of the Milwaukee district, and **A. E. Johnson,** formerly chief engineer, Elkhorn, Wis., plant, replaces Mr. Schneller as sales manager. Mr. Johnson also assumes responsibility for the division's advertising function, formerly handled by **R. N. Stime.** Mr. Stime has been named assistant director of merchandising.

Ronald K. Meyers recently joined Delhi Foundry Sand Co., Cincinnati, as foundry sales engineer in northern Ohio, with headquarters in Cleveland. Previously he was with Inter-Chemical Corp., New York, and Buckeye Foundry Co., Cincinnati.

D. A. Dalton and **J. J. Shellabarger** have been elected vice presidents, Dalton Foundries Inc., Warsaw, Ind. Mr. Dalton, formerly general foundry superintendent, now is vice president in charge of foundry operations. Mr. Shellabarger, formerly foundry division sales manager, is vice president in charge of industrial sales.

A. C. Towne, formerly president, has been named chairman of the board, Michigan Oven Co., Detroit. **L. M. Gill** has been promoted to president from his former position of sales manager. **C. A. Windsor,** formerly in charge of Wire and Wire Products Dept., is now vice president of the company, and **B. C. Smith** has been promoted to secretary-treasurer from secretary and chief design engineer.

Elmer Doerr has retired as foundry sales representative in southwestern Ohio, Frederic B. Stevens Inc., Detroit. His son **Chester Doerr** has succeeded him and will cover the same territory. Prior to joining the Stevens company in 1944, Elmer Doerr was engaged in foundry work with American Steel Foundries and Commonwealth Steel Co., Granite City, Ill., Scullin Steel Co., St. Louis, and General Steel Castings Corp., Eddystone, Pa. Chester Doerr spent eight years with Scullin Steel Co. before he joined Frederic B. Stevens Inc. in 1956.

Paul J. Chaney has been appointed general sales manager, Metals Processing Div., Curtiss - Wright

L. G. CROWLEY

A. E. JOHNSON
. . . sales positions, A. O. Smith Corp.

A. R. SCHNELLER

PAUL J. CHANEY
. . . Curtiss-Wright sales

LOW COST MECHANIZED SAND HANDLING

WITH HANDY SANDYS SAVE ON CAPITAL INVESTMENT

*PATENTED

Handy Sandy, the individual-floor, sand handling unit, has been accepted throughout the foundry industry as the most economical method for furnishing overhead sand at low cost to molding stations. Handy Sandy offers further economies in that it takes a low capital expenditure to progressively mechanize any foundry. In most cases, one installation has led to several within a foundry, and today there are well over one thousand Handy Sandys proving their value in foundries everywhere.

and, only Handy Sandy offers all of these features:

- BUILT-IN AERATOR
- AUTOMATIC HOPPER LEVEL CONTROL*
- SAND VOLUME EQUALIZER
- DRIBBLE GATES*
- AUTOMATIC FEED VOLUME CONTROL*
- LOWER SAND STORAGE HOPPER WITH ENDLESS BELT FEEDER
- AUTOMATIC ELEVATOR TAKEUPS
- LESS HEADROOM
- INSTALLATION FLEXIBILITY
- MANY STANDARD MODELS

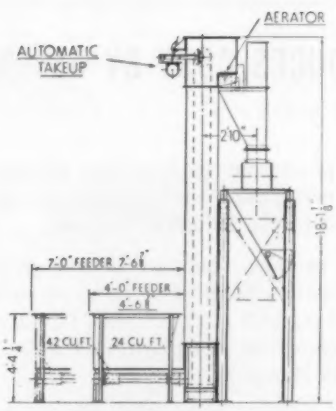
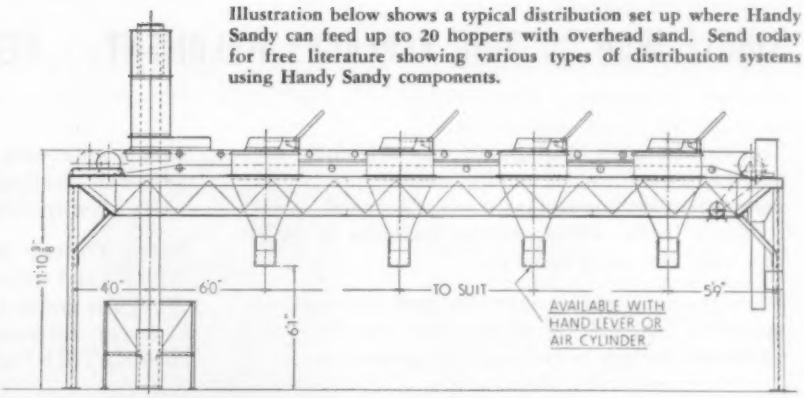


Illustration below shows a typical distribution set up where Handy Sandy can feed up to 20 hoppers with overhead sand. Send today for free literature showing various types of distribution systems using Handy Sandy components.

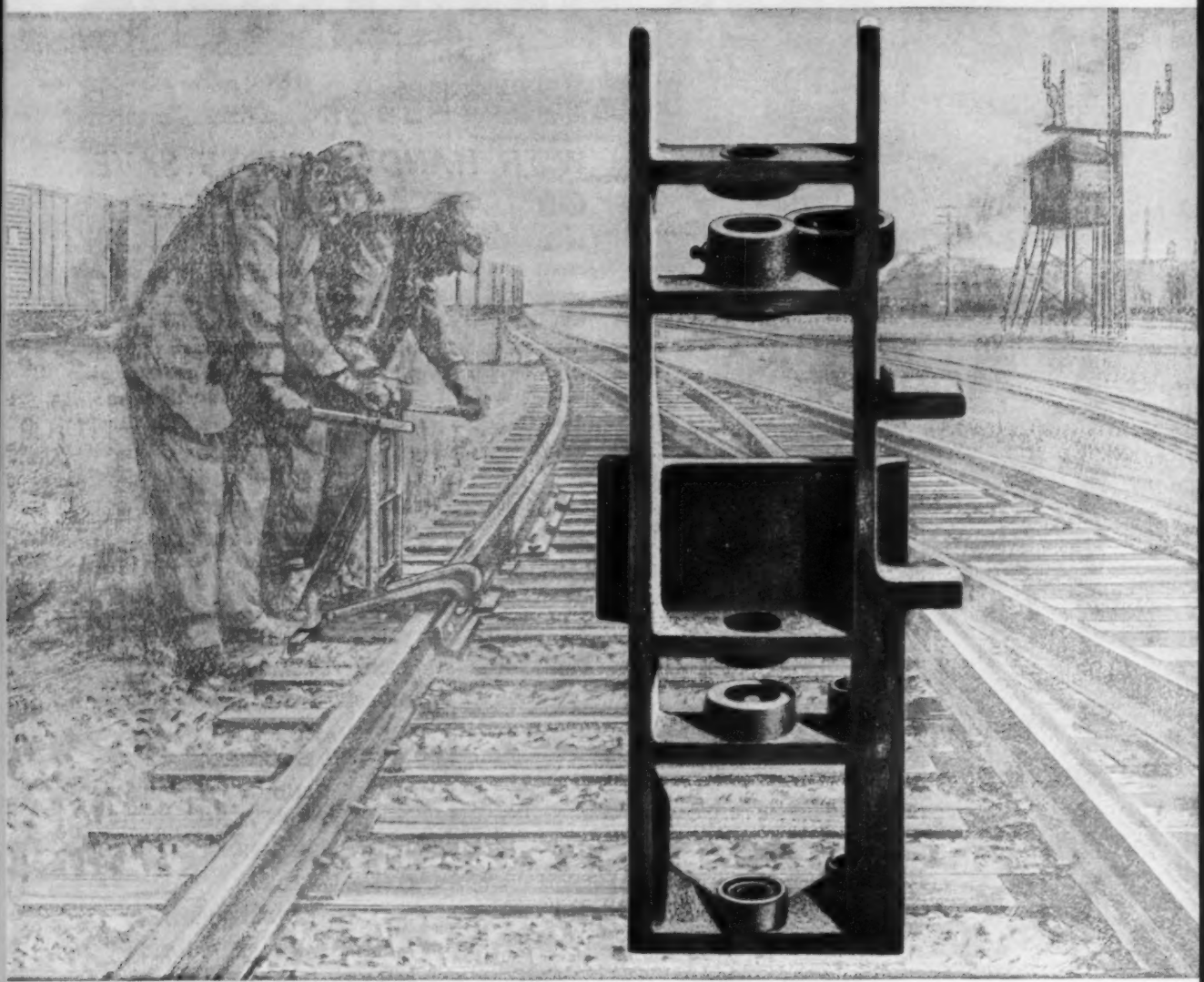


NEWAYGO engineering company
NEWAYGO, MICHIGAN

Send for our new 16 mm sound film featuring Progressive Mechanization in 9 foundries. Use of film is free.

Circle 666 on Page 53

How the Foundry Industry serves America . . . #2 of a Series



SINGLE IRON CASTING REPLACES WELDMENT . . . REDUCES COST BY 66⅔%

This power track drill frame was originally produced as a weldment. It required cutting, positioning, assembling, welding and inspecting 23 separate parts. It was a major manufacturing headache in every way, and the scrap ran high.

Foundry engineers redesigned the part as a one-piece malleable iron casting at one-third the cost, plus additional savings in final machining operations.

This is impressive proof that modern iron castings deliver outstanding performance and impressive economies when specified by the industrial designer.

Hanna Furnace is proud to be part of this great industry and will continue to provide foundries with all regular grades of pig iron . . . malleable, foundry, Bessemer, intermediate low phosphorus, as well as HANNATITE® and Hanna Silvery.

Facts from files of Malleable Founders Society

HANNA
THE BEST KNOWN NAME IN IRON

THE HANNA FURNACE CORPORATION
Buffalo • Detroit • New York • Philadelphia
Merchant Pig Iron Division of National Steel Corp.

Circle 667 on Page 53

CARL L. GRAEBER

RALPH L. LEE

. . . become Westover associates

Corp., Buffalo. He will be responsible for nationwide distribution and sales of alloy forgings, extrusions, and castings. Mr. Chaney was product sales manager for tubular products.

Carl L. Graeber has been named special service associate, Westover Corp. & Associates, Milwaukee. Mr. Graeber's past associations include Falk Corp., Nordberg Mfg. Co., Louis Allis Co., Ampco Metal Inc., Koehring Co., and A. O. Smith Co., all of Milwaukee. **Ralph L. Lee,** retired secretary-treasurer, Grede Foundries Inc., Milwaukee, also has become an associate.

Walter Crafts, associate director, technology, Union Carbide Metals Co., Niagara Falls, N. Y., has been named president, American Society for Metals, subject to election at the ASM annual meeting in November. Other new officers are **William A. Pennington,** professor of metallurgy, University of Maryland, College Park, Md., vice president; **Robert J. Raudebaugh,** supervisor, iron-nickel alloys, International Nickel Co., New York, treasurer; **Albert H. Fairchild,** senior staff engineer, metallurgist, Western Electric Co., Winston-Salem, N.C., and **C. H. Samans,** associate director, engineering research, Standard Oil Co. (Indiana), Whiting, Ind., trustees.

Steve Hughes, general manager, F.E.(North America) Ltd., Toronto, Canada, and **John Wilkinson,** Wilkinson Foundry Facing & Supply Ltd., Toronto, have been elected directors of F.E.(North America) Ltd.

Robert E. French, formerly western sales manager, has become general sales manager, Planet Corp., Lansing, Mich. **Robert S. Miller** has been promoted from eastern sales manager to assistant general sales manager. Both men have been with the company since 1946.

L. Dean Alspach, formerly sales engineer, has been promoted to district manager, Alloy Sales Div.,

ROBERT E. FRENCH

ROBERT S. MILLER

. . . appointments announced by Planet Corp.

In the interest of the American foundry industry, this ad (see opposite page) will also appear in

Iron Age
Modern Castings
American Metal Market

FREE!

REPRINTS OF THIS AD WITH YOUR FIRM'S SIGNATURE

If you would like to have reprints of this ad to mail to your customers and prospects, let us know. Reprints will have no Hanna product message or signature, but will be imprinted with your firm name and address. Absolutely no obligation. To order your reprints, fill in and mail the coupon below.

Hanna Furnace Corporation
Detroit 29, Michigan

Please send me_____ of reprints of Ad No. _____
(No.)

____ of your Foundry Industry Series.

Imprint as follows:

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Send reprints to:

NAME_____

I understand there is no charge for this service.

Circle 667 on Page 53

ARE YOU ADDING WATER TO YOUR SAND *manually?*

eliminate the guess work with the new
DIETERT-DETROIT MILL MOISTMETER

SHOWS moisture content of sand in muller throughout mixing cycle.

ELIMINATES guess-work at sand-preparing station.

REDUCES casting losses through uniform moisture control.

INCREASES mold production by supplying uniform sand to molding stations.

Dietert-Detroit No. 3901 Mill Moistmeter

1. Moisture of sand indicated in mill before discharge. Gives operator constant control for proper water addition.
2. Temperature of sand batches indicated. This shows operator when to add extra water to allow for evaporation from hot batches.
3. Low cost unit provides maximum moisture control for uniform sand batches.
4. Compact, rugged case requires small space. Can be conveniently placed anywhere for maximum operator efficiency.
5. Easy-to-read illuminated meter dials.
6. 6" moisture scale has large indicator hand for greater visibility.
7. Simple, trouble-free circuitry contains no timers, relays or vacuum tubes.
8. Quick representative sampling is assured by a durable metal sensing probe and thermocouple placed in the mixer.
9. **Optional RECORDER** provides permanent record of moisture content in each batch of sand. This compact remote recorder can be used anywhere. Placed in superintendent's office, unit gives exact moisture content at a glance without going out into foundry.

DIETERT DETROIT

HARRY W. DIETERT CO.
9330 Roselawn
Detroit 4, Mich.

HARRY W. DIETERT CO.
9330 Roselawn, Detroit 4, Michigan

Gentlemen:
Send me facts on the new Dietert-Detroit No. 3901 Mill-Moistmeter.

Name_____
Title_____
Company_____
Address_____
City_____ Zone____ State_____

Brush Beryllium Co. Cleveland. **Charles N. Zimmermann** has been appointed senior sales engineer for the New England territory, and **Dean M. Harlan** has been named sales engineer for a Midwest territory.

Donn Fraser has joined the eastern division, Arcair Co., Lan-

DONN FRASER
. . . Arcair Canadian sales

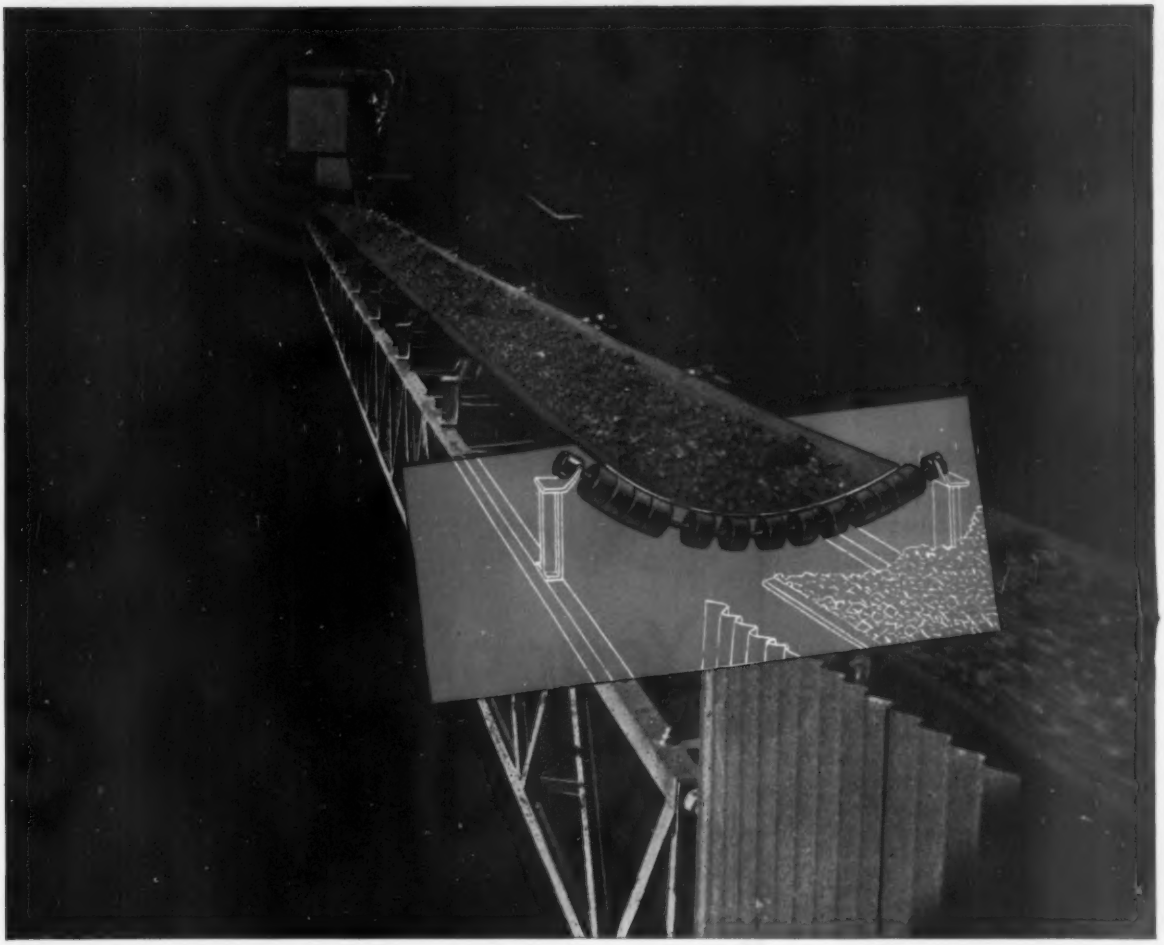
caster, Ohio, as field representative in Canada, with the exception of British Columbia.

William R. Butler has been appointed manager of castings sales, Aluminum Company of America, Pittsburgh. Mr. Butler, in charge

WILLIAM R. BUTLER
. . . casting sales manager

of diecasting sales since 1955, will be responsible for the sale of sand, die, permanent mold, and plaster castings.

Jack E. Heuser has been appointed president of Atlas Copco Pacific Inc., San Francisco, and Atlas Copco Eastern Inc., Paramus, N. J. Both companies are divisions of Atlas Copco A. B., Stockholm,



JOY LIMBEROLLER . . THE *easy going* BELT CONVEYOR IDLER WITH PLENTY OF BACKBONE

Radically different from all other idlers, the Joy Limberoller is a flexible steel cable suspended between two sealed bearings . . . neoprene discs are molded to the cable . . . forming a single roll idler which turns on its own axis. This imparts a flexing action which is self-cleaning . . . prevents material build-up, a source of trouble with conventional idlers.

The Joy Limberoller idler supports the belt across its entire width in a true catenary . . . doesn't bend or pinch the belt between steel rolls like conventional idlers. Hard materials don't "bump along" from idler to idler, either. Belt life is increased 20% and more.

Abrasive or corrosive materials are no problem, because only two bearings are used. They are up out of the dirt zone, not hiding down under the belt where inspection and maintenance are difficult. Joy Manufacturing Company has never replaced a single bearing due to normal failure. Heard enough? Get the whole story from:

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited: Galt, Ontario.

WSW L7373-269

WRITE FOR BULLETIN 269-13

INDUSTRIAL COMPRESSORS

CONVEYORS

ELECTRICAL CONNECTORS

FANS AND BLOWERS

JOY

SINCE 1851 . . . OVER 100 YEARS OF ENGINEERING LEADERSHIP

Circle 669 on Page 53

WOODWARD IRON COMPANY

Established 1882

We are proud of our long association with the Woodward Iron Company, Woodward, Alabama.

Nationally known Woodward Iron, famed for its uniformity and strength, is the choice of many of America's leading foundries.

Where castings of highest quality are required, Woodward Iron will more than meet your specifications for Malleable; Foundry or High Phosphorous.

We invite your inquiries. We believe that you will like the outstanding service that the "Woodward-H-W" team will give you.

There is a Hickman-Williams office as near as your phone.

70th Year of Service to the Foundries of America

Established 1890

Hickman, Williams & Co.

CHICAGO • DETROIT • CINCINNATI • ST. LOUIS • NEW YORK
CLEVELAND • PHILADELPHIA • PITTSBURGH • INDIANAPOLIS
Established 1890

Sweden. Mr. Heuser will be responsible for co-ordinating company operations in the U. S.

Norbert B. Blaski has been appointed quality control manager,

NORBERT B. BLASKI
. . . quality control mgr.

American Foundry Co., Indianapolis, in addition to his duties as chief metallurgist.

Hugh Lowry has been appointed sales representative in the Memphis, Tenn., territory, A. P. Green Fire Brick Co., Mexico, Mo. Until recently he represented Illinois A. P. Green Fire Brick Co., a Chicago affiliate.

Louis V. Abrams, recently employed in management consultant work, has joined Pangborn Corp.,

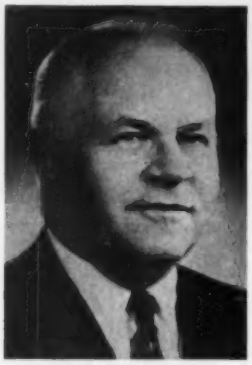
LOUIS V. ABRAMS
. . . joins Pangborn Corp.

Hagerstown, Md., in the newly created post of administrative assistant to the president.

J. Thomas Swift has been named manager of sales, Baker Industrial Trucks Div., Otis Elevator Co.,

Cleveland. **John Knarr,** formerly government sales manager with Baker, replaces Mr. Swift as assistant manager of sales.

Harold E. Koch has been elected executive vice president, Basic Products Corp., Milwaukee. Mr. Koch is president of Hevi-Duty Electric Co., Milwaukee, a division



HAROLD E. KOCH
. . . Basic Products v. p.

of Basic Products. He will retain this presidency and also will supervise management of Hevi-Duty, Anchor Mfg. Div., and Com-Cast Div.

William H. Combs has been elected a vice president, Great Lakes Carbon Corp., New York. Mr. Combs will continue as general

WILLIAM H. COMBS
. . . Great Lakes Carbon v. p.

manager of the company's Missouri Coke & Chemical Div., with offices in St. Louis.

Herbert R. Kalmbach has been promoted to production manager, Ford Motor Co., Cleveland; **Peter Rock** succeeds him as superintendent of the afternoon shift. Both men

Circle 671 on Page 53→

BRIQUETTING SYSTEM

AUTOMATIC SHAKEOUT SYSTEM

BULK HANDLING SYSTEM

PV
FINDS THE ANSWERS

"PV" stands for *Planet Versatility* . . . a quality that has made Planet Corporation known throughout the foundry industry as an organization that has solutions to the most perplexing production, materials handling, or automation problems.

Planet Corporation engineers apply uninhibited thinking to foundry problems to find workable solutions that increase efficiency. No job is too big or too difficult . . . Planet's "PV" engineers have designed complete foundries, automated molding lines, built bulk and unit materials handling systems, developed the world's only true universal transfer device . . . they are experts, in fact, on all types of special handling and automation machinery, and materials handling equipment.

Let Planet demonstrate how its versatile engineering skill, and production and erection know-how can help you. Discuss your problem with a Planet "PV" engineer . . . *it pays to Plan with Planet.*

PLANET CORPORATION

• ENGINEERED HANDLING SYSTEMS
• AUTOMATION EQUIPMENT
• MILL & FOUNDRY HANDLING EQUIPMENT

1818 SUNSET AVENUE LANSING, MICHIGAN

MANHATTAN
REINFORCED CUT-OFF WHEELS

Actual Field records show up to 25% increase in cutting efficiency and cleaning room production with Manhattan Reinforced Cut-Off Wheels. That's because these wheels are specially designed to take the abuse of heavy cutting in foundry operations far beyond the limits of conventional cut-off wheels. Manhattan Reinforced Cut-Off Wheels are reinforced *two* ways. First, special fibers in Manhattan's bond increase by 50% the wheel's strength to withstand destruction by centrifugal force. In addition, super-strength synthetic lateral reinforcement gives a degree of resistance to side-strain not possible with ordinary wheels. Double reinforcement adds up to double safety and protection from breakage, too!

Let a Manhattan sales engineer show you how to increase production efficiency . . . get "More Use Per Dollar" at your shop with Manhattan Reinforced Cut-Off Wheels and other types of Manhattan high speed, heavy duty wheels.

MORE CUTS AT LOWER COST

FASTER PRODUCTION

GREATER SAFETY

CUSTOM-MADE FOR YOUR JOB

RM946

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

Circle 672 on Page 53

QUICK—
ACCURATE
Temperature Readings
in Non-ferrous
Molten Metals with

XACTEMP
Trade Mark Reg. U.S. Pat. Off.
HAND PYROMETERS

Accurate to Within a Fraction of a Scale Division

The XACTEMP PYROMETER makes possible better quality control and helps toward elimination of blowholes, burnouts, sand infiltration and other flaws due to incorrect temperature . . . affords a simple, effective means for accurate temperature measurement of molten, non-ferrous metals. Well-balanced, easy to handle . . . always ready for use and requires no preliminary adjustments.

Cast aluminum and brass construction. Indicator is of medium resistance not affected by thermocouple length . . . acts rapidly . . . provided with Alnico V magnet and direct reading dial starting at 50° F. 43" stainless steel extension . . . standard 7" Marshall tip permits true readings below surface of metal. Made to give good service for years. Order at once to be sure of immediate delivery from stock.

Catalog No. MM701 $68.50
Complete with Thermocouple..

Catalog No. 1449-501T Replacement
Thermocouple Tip $7.60

Ask about XACTEMP PYROMETERS for all-around general temperature checking. A full line of thermocouples available in stock.

5551

GORDON SERVICE

CLAUD S. GORDON CO.
Manufacturers & Distributors
Thermocouple Supplies • Industrial Furnaces & Ovens
Pyrometers & Controls • Metallurgical Testing Machines
607 West 30th Street, Chicago 16, Illinois
2027 Hamilton Avenue, Cleveland 14, Ohio

Circle 673 on Page 53

were transferred to Cleveland from Detroit as general foremen eight years ago.

William Rodgers has been named senior vice president, Blaw-Knox

WILLIAM RODGERS
. . . *senior v. p., Blaw-Knox*

Co., Pittsburgh. In his new post he also will continue as general sales manager.

N. Robert Semple has been appointed sales representative, Lewis-Shepard Products Inc., Watertown, Mass., with headquarters in North Bergen, N. J., to cover eastern Hudson County, N. J. He has been with the company seven years.

Walter H. Flynn has been named general sales manager, Lebanon Steel Foundry, Lebanon, Pa. Mr.

WALTER H. FLYNN
. . . *Lebanon sales manager*

Flynn was chief foundry engineer and manager of Special Products Div.

J. J. Curry has been named Midwest regional sales manager, Yale Materials Handling Div., Yale & Towne Mfg. Co., Philadelphia. He will supervise and co-ordinate activities of

Now!
metal
abrasives
TAILOR MADE
for you

We can now make, and deliver in every shipment, the exact type of "Malleabrasive" shot or grit that will do your particular job best . . . and at lowest cost to you.

With new, precision controlled equipment and specialized techniques "Malleabrasive" is now job-made to meet each individual cleaning condition.

Why settle for make-shift, general purpose abrasives when you can have "Malleabrasive" tailor-made for you? We'll welcome the chance to tell you how you can benefit.

Write us.

Circle 674 on Page 53

THE GLOBE STEEL ABRASIVE CO.
Mansfield, Ohio

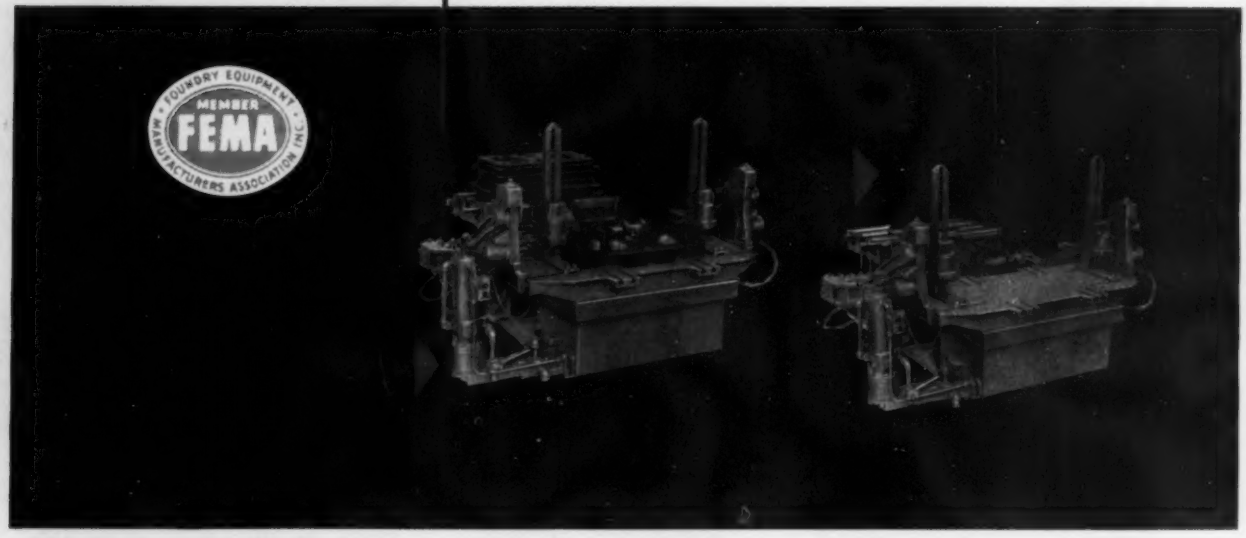
Sold by many leading distributors of foundry supplies from coast to coast.

MALLEABRASIVE

a type and size molding machine for every foundry operation . . . .

Take a minute to look at this further evidence that our molding machines are designed to fulfil the diversified requirements of *all* foundrymen.

Our 750 and 1500 lb. Jolt Rollover and Draw Machines are part of our standard line. They have been known for years as rugged, dependable units, with the built-in quality required to take day-after-day punishment.



HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH 22, PA.

These machines are shipped completely assembled. Installation is fast and economical.

Any repairs can be made above floor level.

Pneumatic clamps, adjustable horizontally and vertically, quickly clamp any mold or corebox size.

One rotary type valve controls all operations easily and simply.

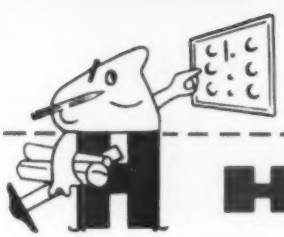
Rollover and draw is fast and smooth, with no jerking or slamming, due to its air-on-oil hydraulic controls.

As you can see, any depth mold can be drawn, and the finished mold is deposited directly on the rear discharge or side discharge conveyor.

Yes, we *do* have a type and size molding machine for *every* foundry operation.

Whether you need an automatic, semi-automatic, push-button or standard machine, there are 15 different Hermans available for selection.

One of our sales engineers will help you pick the one best for you . . . today.



HERMAN

and most progressive

Best Known Name in Engineered Molding Machines

Circle 675 on Page 53

NEW KIRK & BLUM

Dust & Fume Control CATALOG

52 pages showing 60 different installations in major industries

See how Kirk & Blum engineers the best suited dust and fume control system for each particular application.

See how Kirk & Blum provides one source for the complete operating system—design, fabrication, installation—*one* undivided responsibility.

Clip and send coupon below for your copy.

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Please send me Dust & Fume Control Catalog.

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factory sales, service branches, and franchise reprsentatives in Michigan, Ohio, Indiana, and Kentucky.

Howard Voit has been appointed sales-advertising manager, Sterling National Industries, Milwaukee. He joined the sales department of the

HOWARD VOIT
. . . sales-advertising mgr.

former Sterling Wheelbarrow Co. in 1946 and has been New York branch manager since 1951. Chairman of the Metropolitan Chapter of the AFS in 1957-58, he was also active in the New Jersey Foundrymen's Association.

Thomas M. Ware, president, International Minerals & Chemical Corp., Skokie, Ill., has been elected chief executive officer of the corporation. **Louis Ware** continues as chairman of the board.

Donald P. McCaffrey has been promoted to foundry section foreman, Hamilton Foundry Inc., Hamilton, Ohio. Mr. McCaffrey, who

DONALD P. McCAFFREY
. . . foundry section foreman

has been with Hamilton nearly 19 years, recently was sand control supervisor.

ferrous

& non ferrous

SAVINGS

in the melt shop by quick analysis with the

NEW SPECTROMET®

CHEMICAL COMPOSITION IN MINUTES
NO LABORATORY REQUIRED

The Baird-Atomic SPECTROMET allows high precision analysis of alloying and minor elements to be made quickly and easily. Results are reported to the melt shop in minutes permitting corrections to be made prior to pouring. The expanded SPECTROMET is specially designed for rugged, practical use . . . to be operated by non-technical personnel.

SAVE MONEY, SAVE TIME, ELIMINATE WASTE

- Eliminate "off analysis" heats.
- Shorter furnace holding time permits more heats per month, minimum loss of alloy elements, longer furnace life, lower fuel costs.
- Conserve expensive alloying elements by confidently aiming at low side of the specification. Detect harmful tramp elements.
- Install close to the melt shop without need for special laboratory.
- Reduce expenses by saving manpower, supplies, and space.

Only the SPECTROMET offers all these features:

- Results presented on indicator dials directly in percent concentration.
- The *Automatic Optical Servo Monitor* to provide continuous compensation for variation in temperature and atmospheric pressure, vibration and shock.
- Parallel interchangeable read-out channels to increase reliability, facilitate maintenance.
- Logarithmic read-out system to permit wide concentration range on one scale, element standardization with one sample, interchangeable channels without calibration.

Baird Atomic

Baird-Atomic, Inc.

33 UNIVERSITY RD.,
CAMBRIDGE 38, MASS.

Los Angeles/Cleveland/Chicago/Detroit/Dallas/Philadelphia

Circle 677 on Page 53

Many Stainless Castings Used in

ATOMIC-POWERED SHIP

● AMERICA's first atomic-powered merchant ship, the *N. S. Savannah*, makes extensive use of high-alloy castings in the primary system of her pressurized water reactor.

Launched on July 21, the single-screw ship is driven by a 22,000-hp power plant, at a speed of better than 21 knots. Fueled by uranium oxide with a low enrichment, her power plant has been designed to enable the ship to steam three and one-half years on a single core loading.

To insure that the inherent long-life and efficiency of the revolutionary power plant will have its full potential utilized, the Babcock & Wilcox Co., prime contractor for the nuclear plant, chose stainless castings for vital parts of the primary system. Outstanding among these components are the cast stainless volutes and impellers used in the four primary coolant pumps. Both are cast from stainless alloy type CF-8 (Alloy Casting Institute designation); the volute or casing weighs 3150 lb.

Primary Pumps — Two primary pumps are mounted vertically on each of the steam generators (heat exchangers) used in the primary loops. Main coolant water is pumped through the reactor to absorb nuclear fission heat, and then to the tube side of the steam generators. Here, the heat is transferred through the tube walls to generate steam in a secondary circuit. Hooked in parallel, the four pumps return the flow of cooled primary water to the reactor to complete the circuit. The hermetically sealed pumps, supplied by the Allis-Chalmers Mfg. Co., have a design rating of 5000 gpm at 70 psi head and operate at either 3600 or 1800 rpm.

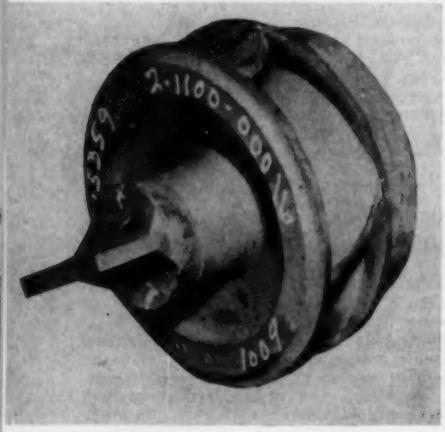
In the reactor vessel itself, 32 stainless castings form part of the transition assemblies, which provide connections between the fuel elements and a grid plate. These castings must maintain a tight seal between the inner and outer flow passages in the core. It is also essential that they introduce a minimum of corrosion products which would become radioactive and travel around the loop. Like the pump castings, the transition assembly castings are also exposed to high-purity water and are made of ACI type CF-8 stainless alloy.

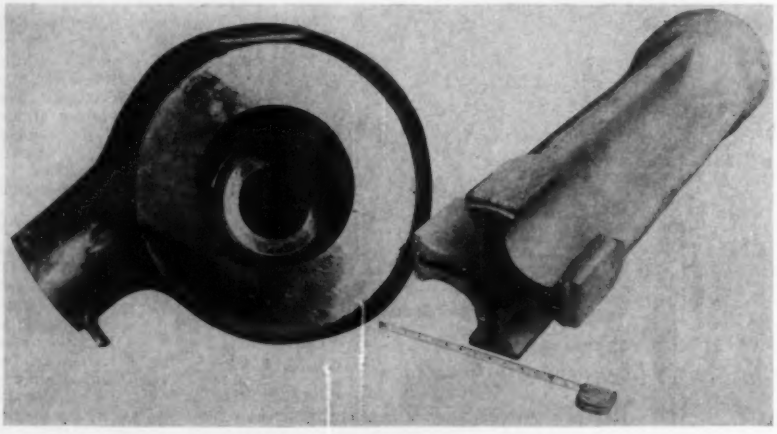
Transition Piece — Another extremely interesting cast stainless component is the transition piece, 21 of which are used in the reactor vessel. These also are critical with respect to shape and corrosion resistance. Cast from type CF-8, these units each weigh approximately 180 lb before machining.

Stainless castings were selected for the *Savannah's* pressurized water reactor for three important reasons: (1) The complex shapes of such parts are most economically made as castings rather than as welded assemblies or forgings; (2) cast stainless alloys provide the combination of corrosion resistance,

Loop pump impeller, shown before machining, weighs 52 lb

Left, 3150-lb volute casing is vital part of a primary coolant pump. Right, transition piece is 1 of 21 used in pressurized reactor vessel





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Please send full information on the DFC line of industrial furnaces.

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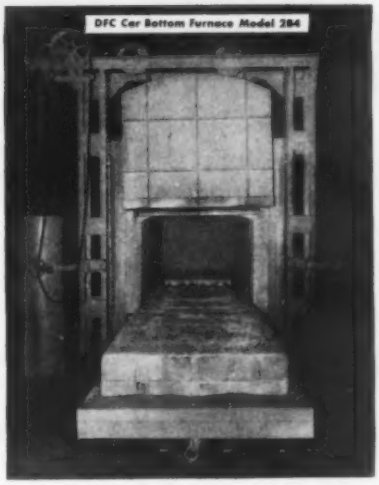
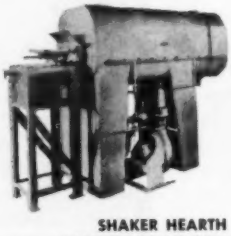
Special Car Bottom, Heat Treating Furnaces

The Denver Fire Clay Company designs and supervises the construction of special car bottom, heat treating furnaces to your requirements.

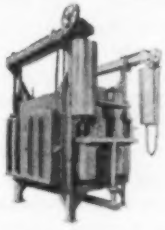
The efficient design of each furnace is assured by many years of experience in the manufacture of industrial furnaces. Constructions for heat treating carbon steel, manganese steel and malleable iron castings; also for stress relieving welded steel assemblies and forgings.

Prerequisites of every DFC Furnace design are **Simplicity, Durability** and **Efficiency.** Let our engineering staff help with your heat treating problem.





SHAKER HEARTH
HEAT TREATING FURNACE



BOX TYPE
HEAT TREATING FURNACE

SEMI-MUFFLE TYPE
HEAT TREATING FURNACE

Denver Fire Clay Company

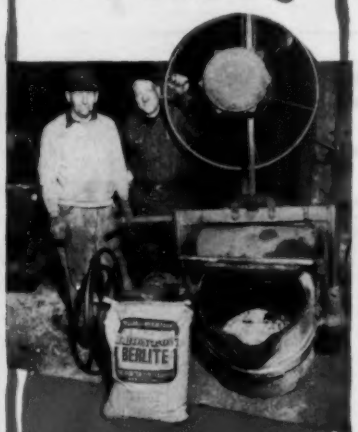
DENVER • SALT LAKE CITY

DF 9-7

Circle 678 on Page 53

At Adell Foundry Co. in Wisconsin, Supt. Bintzler gets

6 months service from "SPLITS and BERLITE" ladle lining



Mr. Bintzler (hand on wheel) and helper with BERLITE-lined ladle.

EASY WORKING. EASY CLEANING

that's what foundrymen want in a lining for grey iron ladles. At Adell, they say nothing ever tried can equal

IRONTON BERLITE

The "Bintzler Sandwich" of BERLITE and brick may be the lining you need. All the details are in a service report that Ironton will send without obligation. Try BERLITE and see why so many foundrymen say it's the only lining they will use for bull and pouring ladles.

SINCE 1917 THE IRONTON FIRE BRICK COMPANY IRONTON, OHIO

1317 Adelaide St.

Write or call Ironton collect for name of nearest representative.

Circle 679 on Page 53

heat resistance, and strength required for the high pressures and temperatures developed in nuclear power generation; and (3) castings can easily be designed with generous fillets and radii to eliminate crevices and possible entrapment of radioactive particles.

In addition to transition pieces for the control rod guide tubes (reactor vessels), volutes and impellers (primary pumps), cast fittings (primary piping), and cast valve bodies (primary valves) are used in the primary system. ACI type CF-8 corrosion-resistant cast alloy is used throughout. This iron-chromium-nickel alloy (nominal composition: 0.08 max C, 19 Cr, 9 Ni) withstands the high pressures (1750 osi), temperatures (500° F) and the relatively corrosive high purity water encountered in the reactor and primary loops.

Although means are provided for continuously purifying the primary water, it is important that the concentration of corrosion products in the primary system should never exceed 0.75 ppm Fe_3O_4. First, impurities could raise the radioactivity to a point above safe radiation limits; second, impurities deposited on heat transfer surfaces would change the heat-flow characteristics; and third, particle build-up in some areas might plug small clearance passages in the core and other components. Experience with similar installations (such as the Shippingport pressurized water reactor) has shown that these dangers are avoided when type CF-8 alloy castings are used.

Meet Rigid Specifications — All phases of casting production—original design, molding, melting, heat treating, and final inspection—are carefully controlled to insure the specific combination of physical and mechanical properties demanded for nuclear service. The following list of inspection and test methods used for primary pump volutes shows how much testing is necessary to meet the rigid specifications for nuclear equipment.

1. Spectrographic—close control of chemical composition is provided through rapid analysis by a direct-reading spectrograph.

2. Radiographic—internal soundness of the castings is checked by inspection with a 24-million-volt

In Milwaukee, The Vilter Manufacturing Company uses . . .

3/4 inch of BERLITE to line 2600 lb. ladles

BERLITE-lined 2600 pound ladle

IRONTON BERLITE

is "insurance" for the Vilter foundry where VILTRITE castings have to be right the FIRST TIME. The superintendent there specifies BERLITE for lining ladles because his long experience shows consistently...absolutely

- NO EROSION
- FORMS NO SLAG
- NO METAL STICKS TO BERLITE LINING

(any skull that forms in ladle is easily knocked out without harm to the lining)

All the facts on this BERLITE application are available from Ironton. If you want to test Ironton BERLITE in a ladle, let us know. We will show you what a RELIABLE REFRACTORY can do!

SINCE 1917 THE IRONTON FIRE BRICK COMPANY IRONTON, OHIO

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Write or call Ironton collect for name of nearest representative.

Circle 680 on Page 53

betatron, as well as cobalt 60, iridium 192, or other isotopes.

3. Dye penetrant—freedom from surface discontinuities is investigated by penetrant oil technique.

4. Mass spectrometer — absolute leak-tightness is established by mass spectrometer detection of any escaped helium gas contained in the casting.

5. Ultrasonic—internal soundness of some sections is determined by testing with high-frequency vibrations.

Reliability of the reactor itself and all primary system equipment is a key requirement for successful operation of this or any nuclear power plant. Both in the reactor itself and in the coolant system, maintenance or major repair work would be difficult and in some cases impossible. In addition, any major rupture in primary system components might be a direct radiation hazard.

Ohio AFS Chapters To Hold Conference on Oct. 22-23

The Ohio Regional Conference on foundry technology will be held at Deshler-Hilton Hotel, Columbus, Ohio, Oct. 22-23. It is sponsored by the five Ohio chapters of the American Foundrymen's Society—Canton District, Central Ohio, Cincinnati District, Northeastern Ohio, and Toledo.

D. E. Krause, Gray Iron Research Institute Inc., Columbus, is general chairman. Dallas Marsh, Cooper-Bessemer Corp., Mount Vernon, Ohio, is program chairman assisted by a committee of representatives of the other four Ohio chapters.

General sessions will cover "Engineering Education and the Foundry," "Applications for the CO_2 Process in the Foundry," and "Shell Molds and Cores." Simultaneous sessions will cover subjects of timely interest in the fields of steel, gray iron, malleable iron, nonferrous metals, maintenance, castings cleaning, and patternmaking.

Speakers at the luncheons are Fred J. Pfarr, Lake City Malleable Iron Co., Cleveland, and AFS regional vice president, and Marvin Homan, assistant director of publicity, Ohio State University. Speaker for the banquet on Oct. 22 has not yet been confirmed.

A Report on

CHICAGO

grinding wheels for metal fabricators and foundries

Today, the Chicago Type 11 Taper Cup, pictured above, is the safest, fastest, most economical wheel for metal fabricators and foundries.

Users of grinding wheels on metalworking and foundry applications can expect the ultimate in engineering design and maximum safety from every Chicago Wheel. We offer you a wide range of wheels including straight and depressed center Reinforced Resinoid—Type 27 Hi-Ply, Chicago Flex; Type 11 Resinoid Taper Cups with Carroll pressed metal safety backs; and a complete range of mounted wheels.

We would like to hear from you regarding your particular application. There is a Chicago Wheel sales representative in every major industrial area, ready to serve you.

Write for Chicago Wheel Bulletin F-9
Special catalog for metal fabricators and foundries illustrates grinding wheels, gives you prices and quantity schedules. Write for your free copy today.

CHICAGO WHEEL
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CHICAGO 7, ILLINOIS

deburring small parts

smoothing large castings

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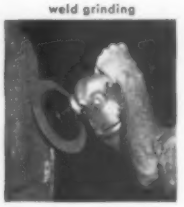
weld grinding



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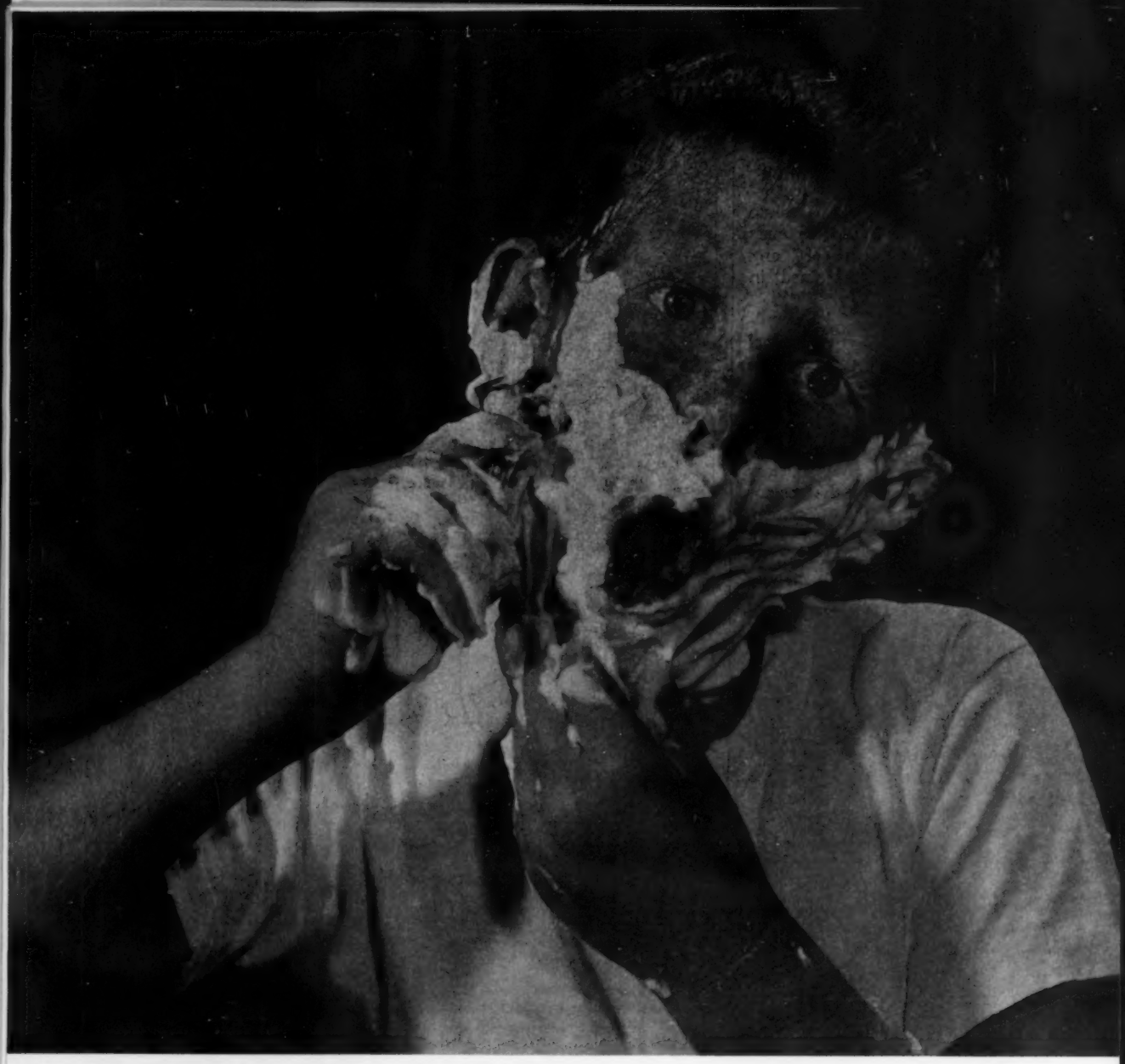


Enthusiasm is no substitute

What you want is faster, better blast-cleaning at lowest cost. That's where experience comes in. *Your* experience in using cleaning equipment. *Our* experience making the kind of abrasive you need.

We've been in business for 37 years. We were the first to manufacture steel shot, AMASTEEL, in 1947. We make no other product, we prefer to *specialize* in the manufacture of shot and grit in our electric furnace. More than 25,000 tons a year!

This specialization (experience!), enabled us to develop our secret, two-step quenching process. It makes steel shot and grit of *uniform hardness* with fewer surface pits or cracks. As a consequence, AMASTEEL wears like a pig's nose!

Use AMASTEEL and your machine maintenance will be reduced 60 percent. AMASTEEL cleans faster than other materials, leaves no carbon deposits or metallic residue. Use it, and you can reduce your storage, handling, freight, and dust disposal charges. The savings in your cleaning department can be substantial!

for Experience!

The AMASTEEL engineer-salesman has been into, under and around every kind of blast-cleaning equipment made, for almost as many years as the process has been used in this country. He knows answers to cleaning problems of every description. With the AMASTEEL Process Proving Machine he will test your cleaning operation, supply the right recommendations, and prove them. Right on your desk top! He also has literature describing how AMASTEEL serves other industries like yours. But why wait for his visit? Write or wire for booklet Number 591. It will be sent to you Special Delivery!

AMASTEEL

ALLOY METAL ABRASIVE COMPANY
121 South Division Street
Ann Arbor, Michigan

Circle 682 on Page 53

"Better Finishing, Faster—With AMASTEEL."

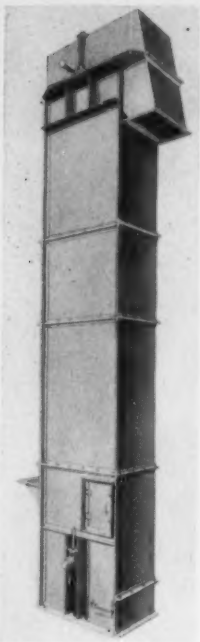
Webster BUCKET ELEVATORS

for handling FOUNDRY SAND

WEBSTER Bucket Elevators can be supplied in practically any capacity. Made in centrifugal, perfect or gravity discharge, continuous bucket, and super capacity types. Buckets can be furnished malleable iron, duramal or steel.

WEBSTER Conveyors for sand, shot, molds, castings, refuse, etc. are widely specified by foundry engineering consultants and used by specialty equipment manufacturers in foundry mechanization programs. All components of WEBSTER equipment are manufactured and assembled in the Webster plant in Tiffin, Ohio.

Write for Catalog BE-55



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Circle 683 on Page 53

Pre-Alloyed Furnace Charges

at a cost less than the price of their original components!

Quality Controlled Stainless and Nickel-Cobalt Alloys in Briquettes, Cut Plates, Stampings and other forms

● These Pre-Alloyed Furnace Charges from Security Alloys, pioneer processors of alloyed nickel, will help reduce your melting time because of their high density and uniform analysis. Tailor-made to most commercial and military specifications, requiring fewer foundry additives and permitting easier prediction of casting analysis.

Color-coded and packaged to your requirements at no extra cost.

For more information on how our Pre-Alloyed Furnace Charges can save you time and money, *write to Foundry Division, Security Alloys Company, Incorporated, 3106 West 49th Place, Chicago 32, Illinois or phone PRospect 6-8500.*

SEND FOR FREE POCKET-SIZE ALLOY SLIDE CHART

Complete analysis of over 100 nickel-cobalt alloys

FOUNDRY DIVISION

SECURITY ALLOYS CO. INC

Obituary

Albert S. Kux, 75, president, Kux Machine Co., Chicago, died July 19 in Chicago. He founded the company in 1919.

James L. Morrison, 85, president, Morrison Machine Co., Paterson, N. J., and president, M. & M. Foundry, Hamburg, Pa., died July 20. In 1904, Mr. Morrison helped found Simpson, Morris, & DeVogel Co., which later became Morrison Machine Co.

Joseph A. King, 62, sales engineer, Republic Coal & Coke Co., Chicago, died July 15.

John K. Schubert, 60, manager of shop operations in the iron foundry, General Electric Co., Schenectady, N. Y., died June 29. He was a member of the Eastern New York Chapter of the American Foundrymen's Society.

Alfred O. Kauffman, 79, former president of Link-Belt Co., Chicago, and a director of the firm for 37 years, died Aug. 7.

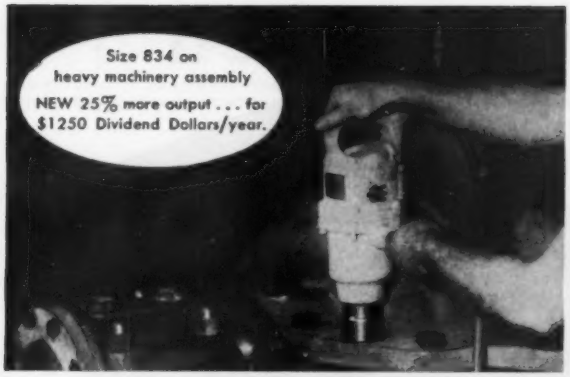
Arthur C. Chapman, 55, formerly with Combustion Engineering Inc., Chattanooga, Tenn., died June 10 in Royal Oak, Mich.

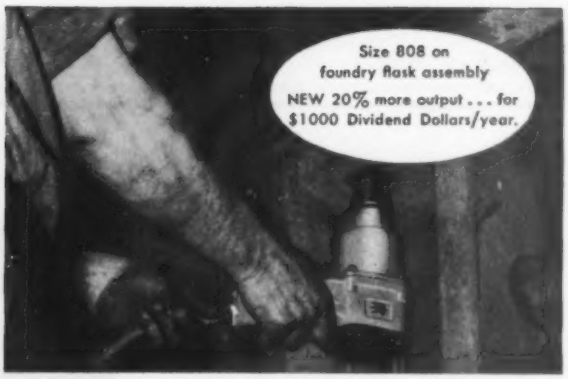
Book Review

Handbook of Practical Electroplating, by Thomas M. Rodgers, cloth, 333 pages, 5 x 7½ in., published by the Macmillan Co., New York 11. Price $8.50.

Information presented in this volume has been designed to meet the needs of people now working in plating shops, supervisors recently assigned responsibility of operating a plating department, and technicians needing some information on plating.

Data on plating solutions include general information on industrial uses and applications, types of equipment required, method of installation of equipment, solution composition, purpose and preparations, recommendations for operating and maintenance of bath, and guide for testing thickness of deposits.





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NEW designs NEW speeds NEW power to give you an

ANNUAL DIVIDEND on your PAYROLL DOLLARS

If your operators are using older model Impactools, you can increase their man-hour productivity by as much as $2000 Payroll Dollars in one year, just by replacing the older tools with one of the 4 new I-R designs.

Multiply these *Annual Dividends* by the number of Impactool operators in your plant, and you can see why management today is taking a new look at portable tool operations.

There's a fast, easy way to calculate the amount of *Dividend on Payroll Dollars* these new I-R Impactools can help you earn in just one year—without adding to your present payroll.

It's yours without obligation. To get it, call your I-R AIRengineer today. Or write Ingersoll-Rand, 11 Broadway, New York 4, N.Y. 8-920

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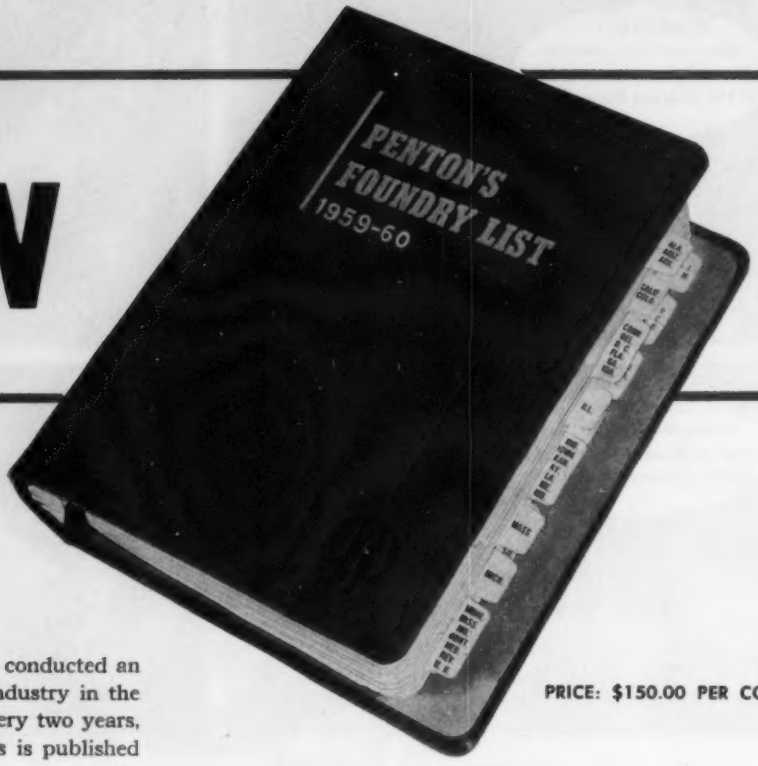
Tools plus AIRengineering increase output per man

Circle 685 on Page 53

NEW



For many years, FOUNDRY has conducted an intensive census of the foundry industry in the United States and Canada . . . every two years, basic information on all foundries is published in . . .

PRICE: $150.00 PER COPY.

PENTON'S FOUNDRY LIST and DIRECTORY

The new 1959-60 edition of PFL is now available. The new directory gives comprehensive information on all 6,085 metal casting plants in the U.S. and Canada (including diecasters). It tells who they are and where they are located; what metals they cast; their melting equipment capacities departments operated; etc.

Well-indexed, and in loose-leaf form, PFL is indispensable to casting buyers and foundry suppliers. Send your order to: Book Department, FOUNDRY, 1213 West Third St., Cleveland 13, Ohio.

ORDER NOW FOR IMMEDIATE DELIVERY

Helping You Sell To Foundrymen

WHEREVER METALS ARE CAST

A PENTON PUBLICATION, PENTON BUILDING, CLEVELAND 13, OHIO

Circle 630 on Page 53

Trouble Shooting

By C. W. AMMEN

Making a Cover Core

Dear Charlie:

We are in the process of making some aluminum molds for a plastic products manufacturer. The mold face has a wood grain finish to make the resulting plastic product look like wood. Mold face is formed with a cover core to be produced in a corebox made of plaster developed from a rough wood plug. Sharp sand is out, and very fine naturally bonded sand blows when rammed hard enough to pick up details. The print has insufficient strength to support the core. Now, unless we go to the trouble of making special arbors, etc., we seem to have had it. How about French or similar sand?

Sincerely,
Sam

Dear Sam:

You probably have one of those jobs we all get into for which the cored surface must be perfect. There are many schools of thought and many ways of attacking your problem, all of which have their good and bad points.

You can rig to leave the cover core on the drag, closing over it, using all green sand of the proper fineness and with enough flowability to pick up the detail. At the same time the core must be vented sufficiently to prevent blowing, or you can use an arbor in a green sand core which is rammed hard. Then dry it thoroughly and spray it with a fine spray of molasses water after removing it from the oven to give it a bit of a skin.

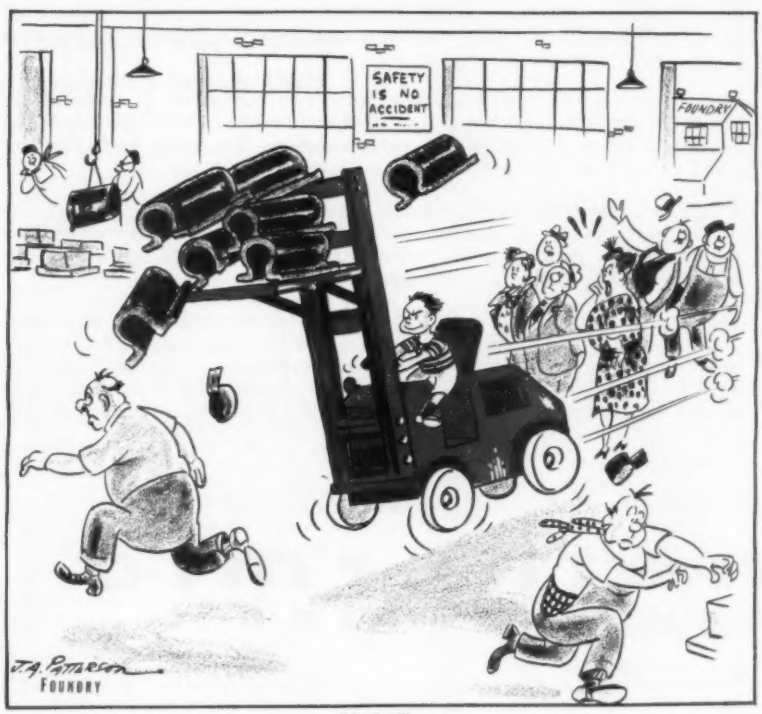
The core can be faced with a fine naturally bonded sand ½ in. thick, backed with oil-bonded sharp sand. This core is baked and sprayed lightly. You also can make the core in fine green sand or use fine sand facing backed with coarser sand. Turn the core out, dust the corebox with cement, print the core back, and dry it in the core oven. You can face the corebox with either gypsum or one of the many investment materials and let the material set. Then cut some interlocks in the inner face, ram it full of oil sand, and dry the core thoroughly.

The latter has one bad drawback unless a rubber or gelatin-faced corebox is used: It is difficult to effect a parting release. Most parting agents used on plaster-to-plaster interfaces will rob you of your detail if applied sufficiently heavily to effect a release.

As a starter, I would rig the box by making a cope and drag mount of it. Riddle about 1 in. of facing on the corebox through a No. 16 riddle, ram firm, coke up the inside to within 2 in. of the bottom board, and vent well.

This procedure is your cheapest out. If you wish, however, you can face the box with green sand backed with oil sand, dry it in the oven, and spray ever so lightly. Either of these two should do the trick.

Once I saw a job with a nasty deep pocket in the cope face of a large pattern which defied all types of gagger, bar, and soldier



"Junior!"

NOW INDUCTION MELTING COSTS LESS THAN EVER...

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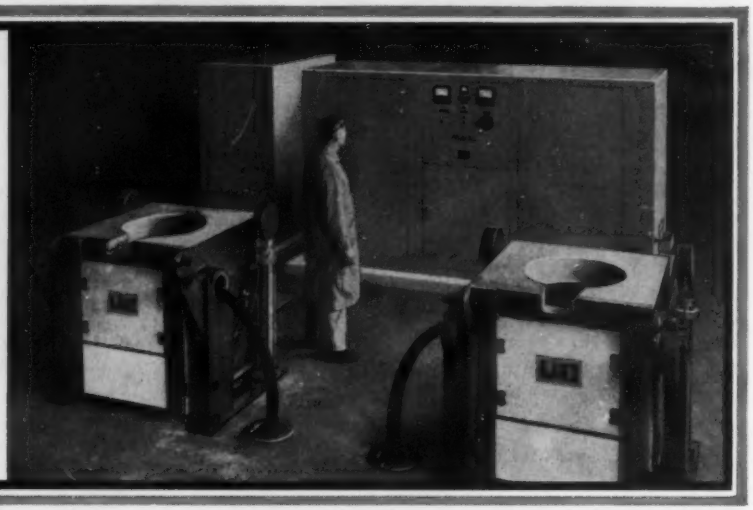
new
Multiductor*
power



*Trademark

* LESS INITIAL COST—The initial cost of a typical Multiductor is less than conventional motor generator type equipment. Further, because the unit is shipped completely assembled and wired, installation costs are drastically reduced. Multiductor requires minimum floor space and uses standard 3-phase, 60-cycle power from ordinary sources.

* LESS OPERATING COST—Operation is so nearly automatic that inexperienced hands quickly become expert operators. Output can be varied continuously . . . while under load . . . from zero to maximum with easy-to-use controls. Damage by overload is practically impossible.

* LESS MAINTENANCE—Multiductor is essentially a static frequency converter. It contains no rotating parts, nothing to wear out, and little to maintain. The number of heats per refractory lining has maintained an unusually high average, going as high as 400 heats with some alloys.

* LESS MATERIAL COST—The strong electromagnetic stirring action of Multiductor powered furnaces promotes rapid melting and diffusion of alloying elements with extremely low metal loss . . . is ideally suited for melting low cost scrap such as borings, turnings, and chips.

* SEE A DEMONSTRATION—Discover for yourself why more and more foundries—at least an additional one each week—are finding that Multiductor Powered Induction Furnaces are one of the greatest melting economizers in history . . . on small furnaces as well as 10-ton units. Write Ajax Electrothermic for a demonstration or an engineer's visit without obligation. Data bulletins are also available.

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Trenton 7, New Jersey

Circle 687 on Page 53

arrangements and would not come up with the cope. This job was licked by ramming it up with reinforcing rods and a hanger eye. A print was made on the upper end by hand tooling. The print was dusted with parting and the cope rammed and lifted off, leaving our friend down in the pattern with a corresponding print left in the cope.

The core formed by this procedure was hung in the core oven to dry, then sprayed. It was a simple matter after that to hang it from the cope and close up. The practice of facing an oil sand core with naturally bonded sand and drying the whole works is by no means new and you will find that on large cores which might cause the casting to crack due to lack of sufficient collapsibility, the method is hard to beat.

Many a big bronze bushing has been made this way to prevent strain and get rid of veining. Where the requirements are not as exacting as in your case, a big oil sand core faced with natural or synthetic sand can be sprayed with blacking and will fall out of the casting.

Sincerely,
Charlie

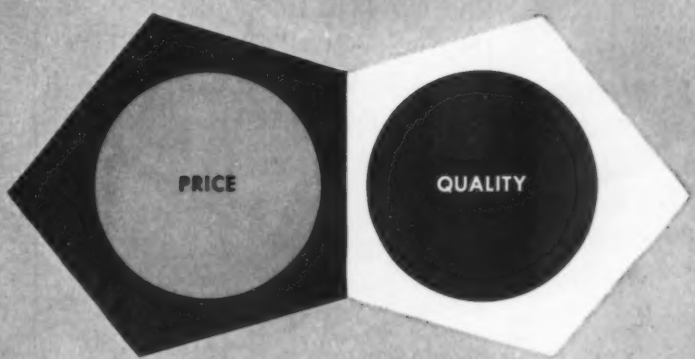
Copper-Base Alloy Properties Compiled for Ingot Institute

Research on mechanical and physical properties of copper-base casting alloys for Brass & Bronze Ingot Institute, Chicago, has resulted in authoritative data pointing toward new applications for bronze castings.

Compiled at Battelle Memorial Institute, Columbus, Ohio, research data on 16 mechanical and physical properties of 80-10-10, 85-5-5-5, and 88-6-2-4 (Navy M) alloys have been compiled. Included are data known previously only by historic record, some never before available.

New applications for bronze castings foreseen by the institute are appliances, aircraft parts; farm and garden tools; railroad bearings, fittings, gears, etc.; building accessories such as valves, plumbing fixtures, etc.; and marine parts. Reprints of the papers are available from the Brass & Bronze Ingot Institute, 308 West Washington St., Chicago 6.

WHICH LOOKS BIGGER TO YOU?



— in buying blast cleaning abrasives, too, low price is just an illusion.

It's not the price per ton, but abrasive quality and resultant performance that control your actual blast cleaning costs. Over 950 field tests against lower priced steel abrasives have proven that top quality WHEELABRATOR Steel Shot can cut your abrasive costs as much as 50%! Start saving now with WHEELABRATOR Steel Shot!

WRITE TODAY FOR THIS NEW HANDBOOK of blast cleaning abrasive performance data, full of charts and facts to help you control abrasive consumption and cleaning costs. *Write to Wheelabrator Corp., 505 South Byrkit St., Mishawaka, Ind.*

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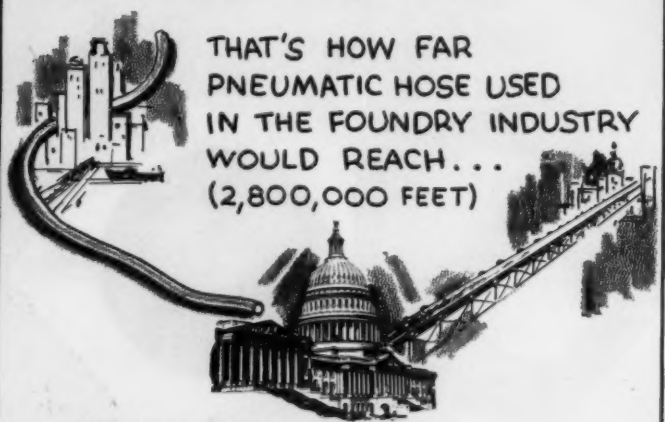
Circle 688 on Page 53

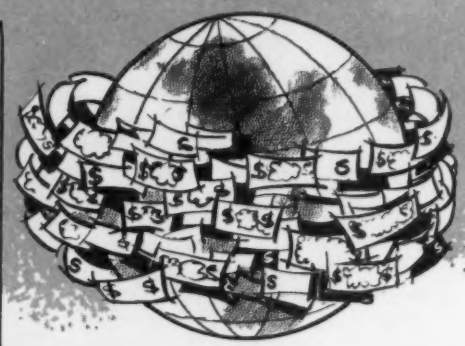
Foundry Facts!

PNEUMATIC HOSE FROM THE WINDY CITY TO THE NATION'S CAPITOL!



THAT'S HOW FAR PNEUMATIC HOSE USED IN THE FOUNDRY INDUSTRY WOULD REACH... (2,800,000 FEET)

...AND CONVEYOR BELTING USED IN FOUNDRIES WOULD EXTEND FROM WASHINGTON, D.C. TO PHILADELPHIA! (1,000,000 FEET)



30 ROWS OF DOLLAR BILLS AROUND THE EARTH!

THE TOTAL VALUE OF ANNUAL CASTINGS SHIPMENTS IS ABOUT **$6,500,000,000**

ALUMINUM CASTINGS ROCKET TO THE MOON

...AND PROBABLY WILL ACCOMPANY THE FIRST SPACEMAN. 14 WENT INTO THE ROCKET WHICH LAUNCHED THE **FIRST** U.S. SATELLITE...

LIKE COMPARING A 5-FOOT DORY TO THE QUEEN MARY!

SHELL MOLDING AND CORE MAKING RESIN SALES ARE ESTIMATED TO HAVE INCREASED FROM 250,000 POUNDS IN 1950 TO APPROXIMATELY **20,000,000** POUNDS IN 1959.

STARTED IN 1900... DURING THE McKINLEY ADMINISTRATION

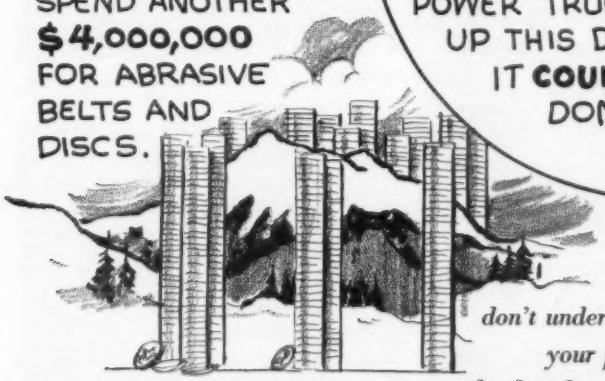
PENTON'S FOUNDRY LIST HAS BEEN ISSUED EVERY OTHER YEAR DOWN THROUGH THE TERMS OF 10 DIFFERENT PRESIDENTS... STILL UNDUPLICATED, STILL UNIQUE!

A HUMAN CHAIN 90 MILES LONG!

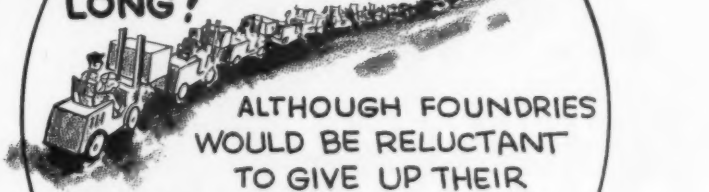
THAT'S WHAT YOU WOULD HAVE IF ALL **75,000** OF **FOUNDRY'S** KNOWN READERS WERE TO JOIN HANDS... IF YOU ADVERTISE IN **FOUNDRY** YOU ARE TALKING TO THE KEY BUYING INFLUENCES IN PLANTS REPRESENTING **98%** OF INDUSTRY'S MELTING CAPACITY...

15 STACKS OF SILVER DOLLARS AS HIGH AS MT. EVEREST

FOUNDRIES SPEND **$31,000,000** ANNUALLY FOR GRINDING WHEELS. THEY SPEND ANOTHER **$4,000,000** FOR ABRASIVE BELTS AND DISCS.



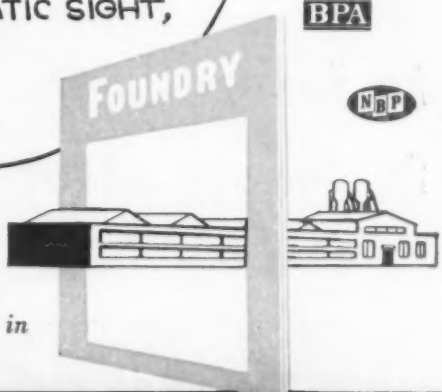
BUMPER-TO-BUMPER CONVOY 26 MILES LONG!



ALTHOUGH FOUNDRIES WOULD BE RELUCTANT TO GIVE UP THEIR POWER TRUCKS TO CONJURE UP THIS DRAMATIC SIGHT, IT **COULD** BE DONE!

BPA

NBP



don't underestimate your potential in the foundry market!

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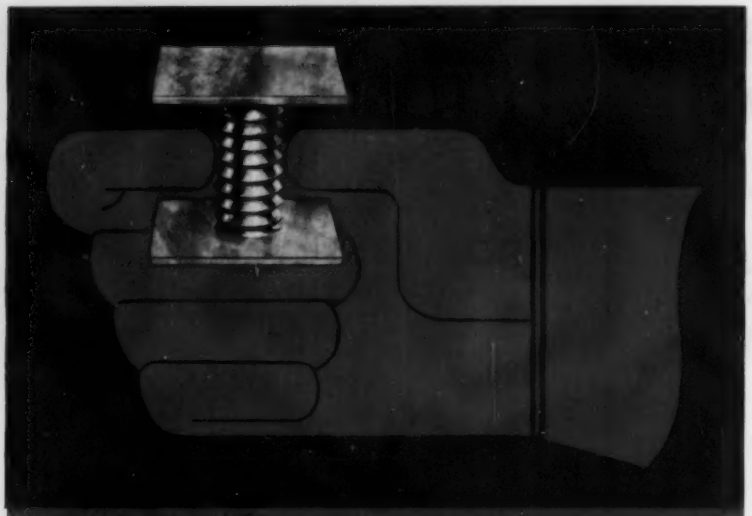

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or CHILL
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to insure better castings
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Foundry Training Courses Starting on Third Series

By Ralph E. Betterley
Training Supervisor, AFS

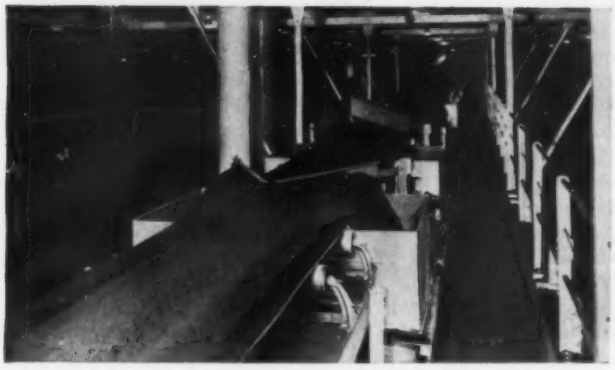
● THE American Foundrymen's Society, Training and Research Institute, is presenting its third series of technical foundry and pattern-making courses.

These training sessions are particularly suitable for foremen, technicians, engineers, line supervisors, and management; according to an analysis of the registered attendance since the inception of the program in 1957, however, practically all foundry job titles have been represented in the courses. More than 1000 class registrants have participated in the 30 courses held to date, and these students have traveled from 32 states, three Canadian provinces, and Mexico to receive this instruction.

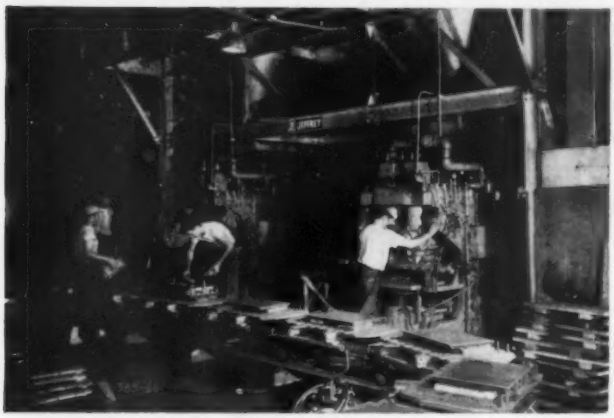
Regional Courses — The courses for the most part, have been held in the concentrated foundry areas of the Midwest; it is in keeping with basic T&RI policy, however, to offer courses on a cosponsorship basis with local AFS chapters where specific training requirements and interests warrant a course for local needs.

Two such courses were held in 1958 at Hamilton, Ont., and Berkeley, Calif., where "Cupola Melting of Iron" was presented. This year the Institute has conducted "Gating & Risering" courses at Birmingham, Los Angeles, and Berkeley, and "Melting of Copper-Base Alloys" at Hamilton.

A T&RI representative met this year with a National Advisory Foundry Committee, working in cooperation with the U. S. Department of Labor, Bureau of Apprenticeship and Training to consider recent data and reports developed by foundry manpower surveys. Cooperative efforts by these government agencies and local foundry groups can substantially assist in the determination of these local training needs and how this training can be provided. The Training and Research Institute courses, in many instances, can assist the metal casting industry by providing some of this training in local areas where specific needs exist and geographical location is prohibitive for



Jeffrey Sand Handling Belt Conveyor with Automatic Plows



Jeffrey Universal Mold Conveyor

Jeffrey Universal Mold Conveyor, Automatic Mold Dumper and Apron Conveyor

Jeffrey Apron Conveyor Handling Castings

you'll see the difference in foundries planned by **JEFFREY**

MECHANIZATION takes over many operations formerly requiring manpower—from sand preparation and distribution to the molders and core makers, to the pouring positions and shakeouts, then back to sand reclaiming and storage—moving raw materials and processing finished castings. Jeffrey services to the foundry industry are that complete.

We'll start with a survey, prepare layouts and recommend equipment, build and install a system to suit your exact requirements. We'll alter existing facilities or replace obsolete units with modern, efficient Jeffrey machinery.

Catalog 911 describes these services and equipment. For a copy, write to The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Circle 690 on Page 53

course attendance in the Midwest.

Industry's Support—The foundry industry has expressed its interest in this sorely needed training program by sending registrants for instruction and, to a large measure, has co-operated unselfishly in furnishing competent experts from the field to serve as practical foundry instructors.

Since the largest enrollment in the courses to date has been developed from production personnel, utilizing foundry industrial experts as teachers gives the practical foundrymen attending the courses a motivated desire to learn from a practical teacher. Where the type of course and the material presented has required it, outstanding professors from many leading universities and engineering schools have enhanced the Institute's presentations in these areas, covering high-level foundry technology developed from the latest research sponsored by AFS.

This support by industry and educational institutions is making a valuable contribution to the training and up-grading of practicing foundrymen.

How Courses Are Conducted — Courses usually are organized for two, three, or five days in length. Detailed outlines and programs are presented to the participating students along with textbooks and other instructional material. Materials and papers provided are, in many cases, publications authored by the instructors who are teaching the sessions. This policy permits a better understanding and more complete discussion of the subject being covered.

A "Question and Answer" session with typical case problems on sand, gating and risering, melting techniques, etc., is a challenging and popular facet of the course sessions. The courses are concluded with a brief, subjective achievement test, in which students are tested on the material which has been presented. Results of this test are made available to the student and management. At the same time, brief questionnaires evaluating the course are completed by the student and returned to the Institute for future reference and course development.

Coming Courses — Courses remaining in the 1959 program are described below. Registration for all courses should be made directly with the American Foundrymen's Society, Training & Research Institute, Golf and Wolf Roads, Des Plaines, Illinois, giving participant's name, title, company, and enclosing the proper tuition check for fees. Fees cover all luncheons and instructional materials.

Patternmaking—Sept. 16-18, at Chicago. Demonstrations and instruction for patternmakers, foremen, supervisors, trainees, purchasers of castings, suppliers, and management—materials, equipment, layout, allowances, construction techniques and recent trends. Emphasis placed on new materials, processes, techniques, and their applications. Fee: $80.

Product Development and *Marketing*—Sept. 28-30, at Chicago. Instruction course on product analysis from the design to the marketing of the finished product. Study will include casting design, stress analysis, pattern selection, equipment, cleaning operations, cost analysis, casting processes, engineering properties of cast metals, and sales promotion. Scheduled for all types of foundry engineers, sales engineers, technicians, supervisors, metallurgists, and management. Fee: $60.

Cutting Costs by Safe Practices—Oct. 5-7, at Chicago. Demonstration and instruction course on savings through a knowledge of workmen's compensation, ventilation, radiant heat, occupational disease, safety in plant design, etc. Plants have little control over insurance premiums. These costs represent only 25 per cent of the actual costs sustained. Informed management can control 75 per cent of these costs. Appropriate for top management, supervisors, engineers, and safety men. Fee: $60.

Preventive Maintenance—Oct. 26-28, at Chicago. Intensive instruction on the "why" and "how" of a preventive maintenance program. Danger points in mechanized foundries having

OLD STYLE GRINDERS
WASTE UP TO 45% OF YOUR GRINDING WHEELS!
AS WHEEL WEARS, SPEED DECREASES, PRODUCTION SLOWS!
STANDARD
INFINITELY VARIABLE SPEED
SNAGGING GRINDERS
adjust automatically with wheel wear to maintain proper peripheral speed.
You get FULL WHEEL WEAR DOWN TO THE FLANGES!

By merely turning a handle — *no tools required* — constant adjustment of wheel speed to compensate for wear is another EXCLUSIVE from STANDARD. STANDARD SNAGGING GRINDER installations coast to coast report wheel savings as high as 100% and increased production of up to 50%. Write today for our "Case History" file of *Savings Up-Cost Down Stories* that are proof positive!

33VR LEFT HAND

Write Today for Literature

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SINCE 1912

the STANDARD electrical tool co.

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HALLMARK OF METALWORKING THROUGHOUT THE WORLD

PARASET CO2 BINDER

What Foundries Are Saying:

"We are saving money . . . getting better cores."

J. F. Hodgkins Co.

". . . tripled production with less cost for labor . . . better collapsibility than from oil sand cores."

Lee Brothers Foundry Co., Inc.

"We use Paraset in casting both Aluminum and Grey Iron."

Foster Aluminum Alloy Products Corp.

For economy and custom collapsibility try Paraset, the proven CO2 binder!

5 Gallon Trial Sample at Low Drum Price

(Specify metal to be cast)

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FOUNDRY RUBBER, INC.

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Circle 692 on Page 53

Eliminate pinhole porosity and oxide inclusions in aluminum castings with

Foseco DEGASERS

This bulletin tells you how. Send for your free copy today.

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Circle 693 on Page 53

automatic and semiautomatic equipment. Cutting costs and reducing down time with an adequate maintenance program. Valuable assistance and guidance for foremen, supervisors, superintendents, and management. Fee: $60.

Permanent Mold and Diecasting—Nov. 9-11, at Chicago. Both theory and practice are emphasized for foundrymen interested in learning the latest developments in their growing fields. Molding materials, gating, and risering, new alloys, methods, equipment, and product application. Fee: $60.

Sand Control and Technology—Nov. 30-Dec. 4, at Chicago. Instruction course for foundrymen having had some experience in sand testing, control, and technology. Mold wall movement, hot deformation, creep deformation, mold atmosphere, heat transfer, mechanical properties, and metal penetration are included. Students bring case problems to class for discussion and solution. Prerequisite: Course No. S1A (Sand Testing) or equivalent experience. Fee: $90.

Industrial Engineering—Dec. 7-11, at Milwaukee. Advanced course. Instruction and workshop course for personnel experienced with basic industrial engineering principles. Practical cost control procedures applied to foundry operations, including work sampling, rating practice, and statistical quality control. New techniques in industrial engineering are considered for foundry application. For industrial engineers, cost control personnel, quality control engineers, supervisors, and management. Fee: $150.

New England Chapter of AFS Elects 1959-1960 Officers

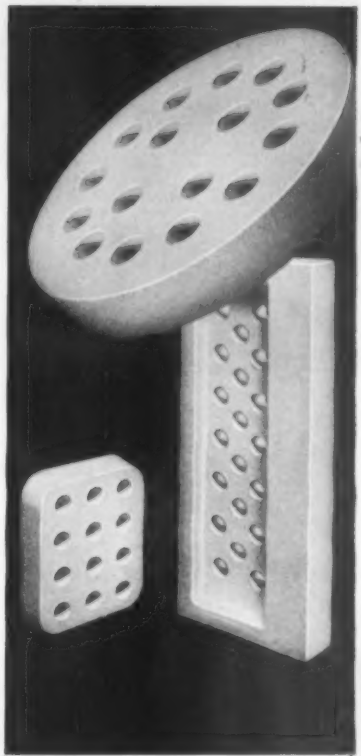
Ahti A. Erkkinen, general manager, Fremont Casting Co., Worcester, Mass., has been elected president of New England Chapter, American Foundrymen's Society, for the coming year.

Other new officers are Philip C. Smith, manager, Pattern Shop, Everett Steel Foundry, General Electric Co., first vice president; Lewis W. Greenslade Jr., foundry superintendent, Brown & Sharpe Mfg. Co., Providence, R. I., second vice president; Daniel J. Pendergast, Sterling National Industries, Boston, secretary; and Thomas I. Curtin Jr., president, Waltham Foundry Co., Waltham, Mass., treasurer.

Book Review

What Every Supervisor Should Know, **by Lester R. Bittel, cloth, 451 pages, 6 x 9 in., published by McGraw-Hill Book Co., New York 36. Price $7.95.**

Any supervisor from a foreman through mid-management will find this volume, with answers to 700 questions, of interest and value. After defining the supervisor's job, the author considers people at work, the fundamentals of supervising people, special techniques in supervising people, procedures in managing a supervisor's job, and how the individual can help himself to succeed. A selected bibliography for further reading and a guide to visual aids are included.



Louthan strainer cores cut foundry costs

You minimize casting problems, get cleaner castings when you use Louthan *refractory* strainer cores. Now available in more sizes and shapes—and for steel, iron, brass and bronze castings. All provide an accurate choke for positive control of metal flow, eliminate slag and oxide inclusions.

Write for Free Gating and Risering Refractory Folder. Complete file of specifications on all Louthan products.

LOUTHAN

MANUFACTURING COMPANY

A DIVISION OF FERRO CORPORATION

EAST LIVERPOOL, OHIO

Circle 694 on Page 53

Castings are pulled off sorting belt and tossed into hoppers. Fork truck is about to remove filled hopper

Hopper Use Facilitates

HANDLING FOUNDRY MATERIALS

Castings from sorting belt go to blast cleaning machine in self-dumping hoppers

Castings are delivered directly to grinders in hoppers which are set on simple pedestal at convenient height

● THE CONTAINERS in which castings are moved from one process to another in a foundry are often regarded as incidental to the overall plan for material handling. Yet the containers themselves can add to, or detract from, the general efficiency of the handling operation.

This observation comes from Edward C. Zuppann, foundry manager of the Lakeshore Div., Bendix Aviation Corp., St. Joseph, Mich. It indicates why, three years ago, Lakeshore decided to replace all 200 tote boxes used for castings with self-dumping hoppers. The replacement program was deliberately spread over a three-year period, to allow a controlled changeover.

Three objectives led to the switch to hoppers: Greater safety in handling castings; less damage

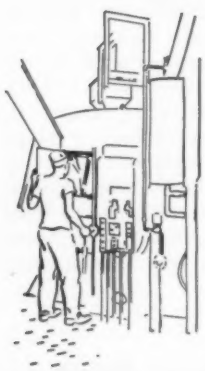
Special sands are delivered from mixer in self-dumping hoppers. Once driver trips lever on hopper, dumping action is automatic

Prepare your sand *AUTOMATICALLY*

with a

Clearfield

mixer



Fast thorough
sand preparation

Complete uniformity in sand preparation is assured by using a Clearfield Mixer with Automatic controls. The operation of any Clearfield Mixer may be made partly or completely automatic by the use of electric time control apparatus. Length of tempering period, quantity of bond and moisture additions are predetermined, substituting individual judgment. The controls may be easily changed to produce any type of sand desired.

Write for Catalog No. 90. Gives full details on the Clearfield Mixer for your need.

CLEARFIELD
MACHINE COMPANY
CLEARFIELD
PENNSYLVANIA, U. S. A

Circle 695 on Page 53

to castings; faster handling, thus faster production.

Tests showed that hoppers have advantages in safety and speed of handling, particularly when unloading or transferring castings. Self-dumping hoppers empty automatically without manual labor. When a lock handle on the rear of the hopper is released, the hopper tilts forward to dump itself, then swings back to an upright position and locks automatically.

Damage to castings has been reduced considerably since the changeover. When a hopper is emptied, its contents slide out rather than tumble, hence there is less impact between pieces. Castings come through with fewer broken corners and damaged bosses.

Hoppers are easy to handle by fork truck—Lakeshore's principal method of moving hoppers from one area to another. They have a built-in pallet which permits easy fork entry, and they can be emptied while held at any height by the fork truck. Hoppers also can be tiered—full or empty—in storage, easily accessible by fork truck. Using three sizes of hoppers—¾, ½, and 1 yard—permits matching hoppers with the size and quantity of castings being carried.

Slag from melting furnaces is chilled in water trough behind wall and carried by conveyor for discharge into a hopper

All of Lakeshore's hoppers are manufactured by Roura Iron Works Inc.

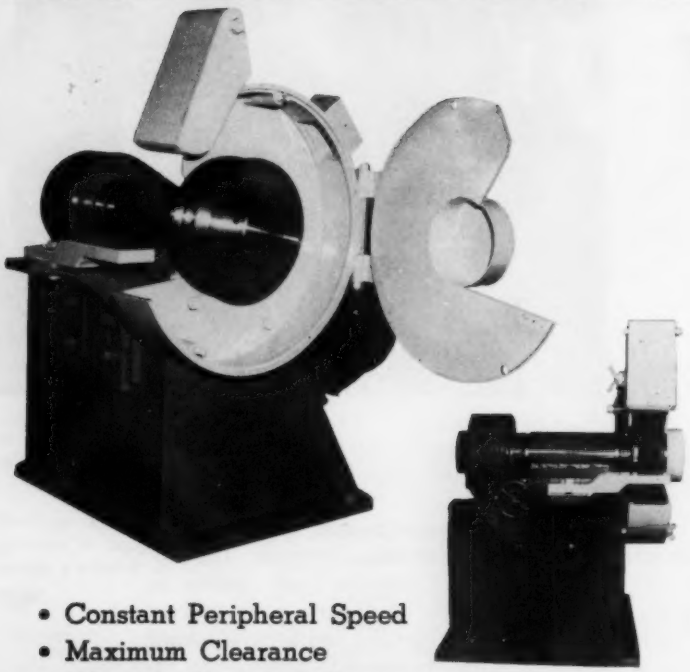
Following is a partial list of the functions which hoppers now perform for the Lakeshore foundry:

Store and cool castings coming from shakeout; receive castings from sorting belt; carry castings to inspection line; move castings to blast cleaning machine; move castings to grinders; transfer castings to chipping stations; transport castings to tumbling machine; move foundry sand from mixer; receive waste from blast cleaning machine; carry cupola slag to disposal area; handle miscellaneous waste.

Pittsburgh Chapter Officers

Pittsburgh Chapter, American Foundrymen's Society, has elected officers for 1959-60. They include James D. Wilson, Bronze Die Casting Co., Pittsburgh, president; W. D. Hacker, Mesta Machine Co., Homestead, Pa., vice president; E. P. Buchanan, Pittsburgh Coke & Chemical Co., Pittsburgh, secretary-treasurer; and A. M. Cadman Jr., A. W. Cadman Mfg. Co., Pittsburgh, director for three years.

In tough grinding nothing beats a FOX



- Constant Peripheral Speed
- Maximum Clearance
- Vibration Free Spindle
- High Production • Low Maintenance
- Operator Safety

FOX #1-24
10-15-20 horsepower: Grinding wheel 24 x 3 x 12".

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15-20-25 horsepower: Grinding wheel 30 x 3 x 12".

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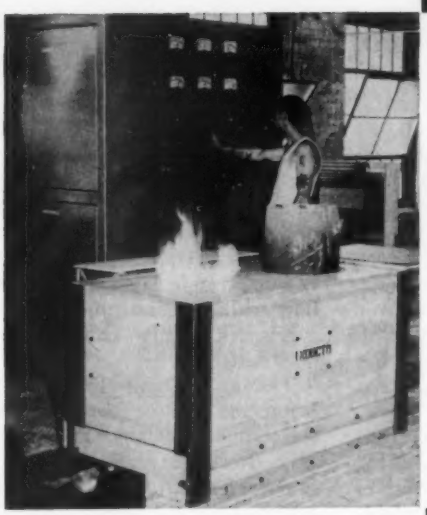

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LOWER METAL LOSSES

Metal losses, as encountered in conventional melting practices, are reduced to insignificance by INDUCTOMELTING. The savings realized with Inducto melting equipment, though substantial in all metals, are particularly great in the easily oxidized or volatile alloying materials.

One non-ferrous foundry cut melting losses 80% through INDUCTOMELTING. This was made possible by higher melting speeds and the remelting of chips and turnings from machined castings which could not be done with the previous equipment without extremely high metal losses.

Why? Why should Inducto melting equipment provide such savings in metal? Because every component is designed and selected for the highest possible efficiency so that you can attain all the benefits of high-frequency induction melting at its best. With Inducto equipment, you get the highest possible melting speeds and the most accurate temperature control in the melting field today. Write for complete details—ask for Bulletin 70. Inductotherm Corporation, 412 Illinois Ave., Delanco, N. J.

**INDUCTOMELTING is high-frequency induction melting PLUS the additional advantages of Inducto design features and engineering techniques.*

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INDUCTO ... the mark of modern melting

Circle 697 on Page 53

for FASTER MOLDING and UNIFORMLY SOUND CASTINGS

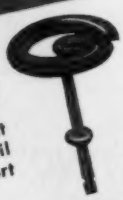
Cleveland CHAPLETS

● Cleveland Chaplets provide you positive core support with the convenience of uniform stem and plates to speed molding. You'll find that their improved break-off design also reduces handwork to speed cleaning. You'll like the convenience of Cleveland service, too!

Delivery without delay!

PRECISE CORE SUPPORT

Sand packs tight through open coil for rigid support in mold.



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DIMENSIONALLY UNIFORM

Uniform stems simplify molding, prevent annoying sand break-outs.

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EVENLY TINNED for CONTROLLED FUSION

Even tinning over clean metal gives uniform fusion for core support during critical stage.

DOUBLE-HEAD MOTOR CHAPLET

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The Sandman Says

By HAROLD E. HENDERSON
H. C. Macaulay Foundry Co.
Berkeley, Calif.

"A Foundry Immortal"

● WHEN WE of the United States turn our thoughts to human greatness, we invariably think of such men as Lincoln, Jefferson, and Washington. It is reassuring, however, to note that fame is not confined to warriors and statesmen. Men in many fields of endeavor have, through patient and selfless contribution, earned the undying gratitude of their fellows. Pat Dwyer was such a man.

I never saw Pat face to face; yet, through "The Adventures of Bill," I knew and loved the man. He had a quality and depth of understanding that few men have been able to transmit via the printed word. His books on *Gating & Risering, Tales From the Gangway,* etc., have been read and treasured by a multitude of foundrymen all over the world.

These books reveal a lifetime of thought and experience with trowel and rammer that would be difficult to duplicate. His knowledge of both men and literature was extensive, and in writing he drew on all this knowledge with tremendous effect.

It has been said that you can judge a man largely by the company he keeps. Pat Dwyer kept good company. I recently became acquainted with one of Pat's bosom friends, Dewar Forbes, a retired patternmaker, well known to readers of FOUNDRY. Mr. Forbes has graciously permitted me to read a number of lengthy letters which Pat wrote toward the close of his earthly journey.

These letters, never intended for publication, provide a portrait of the sender which no camera ever could capture. They convey the warmth and friendliness of a man who loved his friend. A strain of homely humor and philosophy seemed to flow without effort from his pen or typewriter. These could never be dead letters!

Thanks to Dewar Forbes, I have before me a letter from Pat Dwyer the second—a letter that I shall always treasure. Like those of his famous father, this letter was not intended for publication and hence is enriched with a spontaneity never achieved by studied effort. With the permission of Mr. Dwyer, I am happy to present this letter in its entirety.

Dear Mr. Forbes:

Your kind inquiry about my father on behalf of your friend, Mr. Harold Henderson, is lying here in front of me, and I don't know what to do about it. If I were to sit down and write about Pappy, I would be setting myself a full-time job for a considerable period. On the other hand, if I were to select simply a few items about him, I wouldn't know which ones to select. So, as a compromise, here is a brief resume:

Patrick Dwyer was born in a village called Horse and Jockey, not far from Clonmel, Tipperary, Ireland, Aug. 5, 1875. His father, Richard, was raised in the county poorhouse because his parents died of starvation in the great famine. Richard came to America in 1862

To Clean Electric Furnace Fumes To 550° F

BETHLEHEM PACIFIC COAST STEEL

SELECTS THERM-O-FLEX GLASS FILTERS!

SELECTION MADE AFTER EXTENSIVE PILOT PLANT STUDIES PROVED "THERM-O-FLEX" ADVANTAGES

To insure clean gas emission from two 100 ton electric furnace operations at its West Seattle plant, Bethlehem Pacific Coast Steel Corporation has installed a Western Precipitation "Therm-O-Flex" Hi-Temperature Filter system—*the filter system featuring silicone-treated glass bags that efficiently clean gases as hot as 550°F!*

This is the first steel plant installation in the West to use glass bag filters for cleaning electric furnace emissions, the installation being made only after an exhaustive pilot plant study by Bethlehem Pacific engineers. Subsequent operation of the full size installation has clearly substantiated the pilot plant results and has demonstrated the unusually high collection efficiency of "Therm-O-Flex" equipment on this type of application.

No Shaking Required

In addition to their ability to handle unusually hot gases, the specially-treated woven glass filters of the "Therm-O-Flex" permit the filter units to be easily cleaned by simply collapsing the bags. *No destructive shaking processes are required.*

Furthermore, the large diameter filter tubes (12″ in diameter) provide more efficient cleaning of the collected material on each collapsing cycle—another operating advantage engineered into each "Therm-O-Flex" installation by Western Precipitation dust control "know-how."

"Therm-O-Flex" is one of six types of gas cleaning equipment offered by Western Precipitation—"Cottrell" Electrostatic Precipitators, "Multiclone" Centrifugal Collectors, "CMP" Combination Multiclone-Precipitator units, "Therm-O-Flex" Hi-Temp Filters, "Dualaire" Jet-Cleaned Filters, and "Turbulaire-Doyle" Scrubbers. No other organization provides such wide range dust collection experience — no other offers such unbiased recommendations to fit the requirements of your particular operations. You simplify your gas-cleaning problems by bringing them to Western Precipitation.

Send for "Therm-O-Flex" Bulletin #F105!

Only WP has all 6

1. COTTRELL Electrical Precipitators
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Circle 699 on Page 53

or 63, was drafted into the Union Army, saw service with the Army of the Tennessee, was discharged in 1865, and returned to Ireland the following year.

Richard married Bridget Doyle in 1872. They had five children: Margaret, Patrick, Michael, Richard and James. They all lived in miserable poverty in Clonmel until 1887, when Richard availed himself of an offer by the British Government to go to Canada at reduced travel rates. Richard went first and got himself a job as a gardener with a wealthy family in New Glasgow, Nova Scotia. A few months later the rest of the family came over in steerage and settled down in a house on the estate of Richard's employer.

Patrick had one year of schooling in New Glasgow, and then was sent out to work to help support the family. For a short time he was a clerk and errand boy for a dry goods merchant, who soon told him he had no future in dry goods. Looking about for work, he entered Mathewson's Foundry in New Glasgow and apprenticed himself to be a molder.

When he had served his time, he became a hobo molder and set out to see the world. He worked at his trade in Ansonia, Conn.; Norfolk, Va.; St. John's, Que.; Hamilton, Ont.; Detroit; and Cleveland. Returning to New Glasgow in 1902, he renewed his acquaintance with Margaret Chisholm and married her. They moved to Sydney, Nova Scotia, an old fishing village turned into a boom town because of the construction of the Dominion Iron & Steel Co. plants.

Somewhere along the line Patrick had taken correspondence courses in metallurgy, drafting, and associated engineering subjects. He even had studied David McLean's celebrated system on steelmaking. So in Sydney he became foreman of the open hearth first, then superintendent of the steel foundry.

In his younger days he was quite gregarious and belonged to many union and social organizations. Curiously, he never drank. He told me that his mother was dead set against liquor on account of the ruin it had done to her family and then he had seen for himself the wrecks it had made of other men.

He was an omnivorous reader; he read anything, anywhere, anytime. When he didn't understand what he was reading, he would go over it again with the help of a dictionary. That is why, for a man who never had the benefit of formal education, he had a remarkably extensive vocabulary.

In 1912, during the prewar depression, he leaped at the opportunity to become superintendent of a Cleveland foundry. So he bought himself a green suit and a ticket on the steam cars to Ohio and set out to better himself. Unfortunately, something very personal turned up between him and the company. I never did get the whole story, but it was so unpalatable that he quit and returned to Sydney in less than two months.

That was a bitter pill. His old job, of course, was gone, so he took another as foundry foreman at Clark's Foundry & Machine Shop at less money. He told me later that this was one of the low points in his life.

ISOLATION BOOTH

for noisy factory operations

ISOLATE the din and clatter of loud factory operations easily and quickly. Noises can be absorbed or isolated with Koch's easy-to-erect Soundbar Panels. Standard dimensioned panels fit together rapidly to construct a room-within-a-room to control the clamor of factory, mill, or foundry. Noise is not only isolated, it is muffled as well. The unique design of Koch's Soundbar Panels permits "chain erection" to complete a sound suppressed room in hours instead of days. These incremental modular panels lock tightly into each other to form rigid walls of any length . . . any height.

Sturdy steel panels, four inches thick, contain sound-silencing filler. Millions of tiny pores in the skin of the panel trap the sound waves and muffle them within the blanket of insulation. Reverberations within the room or booth are reduced to a minimum.

Simple to erect
Minimum installation cost
Sturdy, all-steel welded panels
Vermin-proof, noise-proof, dust-proof
Light weight, easy to handle
Sound absorption coefficients up to 99%

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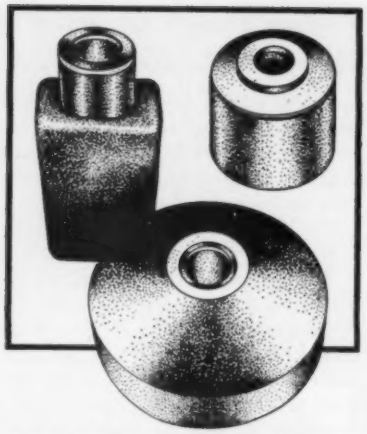

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Over one half million have been used with complete satisfaction. Send for catalog on complete line of butts and peins. We feature 13 types. Sand rammer butts are our business, not our sideline.

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Improve surface finish, increase die life and control casting solidification with

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coatings for permanent molding and die casting components

This bulletin tells you how. Send for your free copy today.

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FOUNDRY SERVICES, INC.
P. O. Box 8728, Cleveland 35, Ohio
Circle 701 on Page 53

He became the father of eight children: Richard and William (twins), Christina Margaret, Patrick, Bridget Aileen, Florence Genevieve, Michael Augustine, and Alice Vivian. Those were pretty fancy names, but were noted only on baptismal certificates. The kids were known as Dick, Bill, Molly, Paddie, Biddy, Jim, Mike, and Al.

Patrick was a writer as well as a reader. He contributed many technical articles to Canadian and American trade papers, notably *The Molder's Journal*, edited, I think, by John P. Frey. Recuperating from the flu in 1918, he began wondering how Solomon ever cast the columns for his temple. He asked me to fetch him the Bible—we had an old beat-up King James version, which my mother regarded with suspicion—and he asked me to read the description aloud while he thought it over.

Eventually he came up with his own solution, which he incorporated into an article including an alter-ego character whom he dubbed "Bill." He sent the story and drawings to FOUNDRY here in Cleveland. A. O. Backert was vice president of Penton Publishing Co. at that time and also editor of FOUNDRY. He bought the article at once, and, better yet, offered Patrick a job as associate editor.

The family moved to Cleveland in June, 1919. He was named engineering editor a few years later, and enjoyed an association with the Penton Publishing Co. until his death in January, 1954. He is survived by a sister, Margaret, in Nova Scotia; a brother, Richard, in California; 6 children, with assorted sons and daughters-in-law, 15 grandchildren, and 3 great grandchildren.

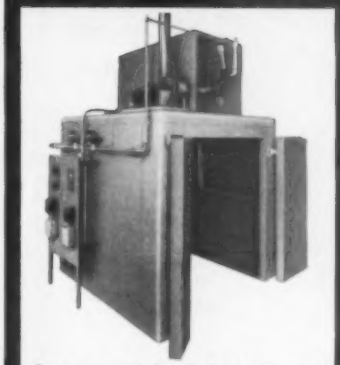
Of course, this is not very much to go by. You can't reduce a man's life to a few lines of type, most of it laudatory, and expect to get a true picture.

Cordially,

Pat Dwyer

To any young man who feels that the world has cheated him, I would recommend a second, slower reading of that letter. To those who knew and loved the elder Pat Dwyer, this letter is apt to revive nostalgic memories of a man who has earned his niche among immortal foundrymen.

LANLY heat processing equipment for the FOUNDRY INDUSTRY



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If a need arises to replace or improve your Foundry Ovens, it is only logical to look to LANLY, recognized authorities in the design and construction of heat processing equipment for more than 22 years.

TODAY may be the opportune time to survey your present facilities and request the counsel of a LANLY representative at no obligation.

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Chill Nails and Spiders
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ACCURATELY CONTROLLED FOUNDRY CHILLING
Write for samples and prices
Choose any style from Jumbo to Stubby; slim, medium or horse nail blade; blunt, pointed, straight or 90° bent. There's a type and size Koolhead Chill Nail or Spider Chill to do your specific chill job best.
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HORSE NAIL CORP
NEW BRIGHTON, PA
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No. 119
Sterling
HEAVY-DUTY
CART
If you're looking for a good tip for wheeling coal, scrap, chips, turnings or similar heavy materials, see these Sterling Heavy Duty Carts. Over and over again the "3-Point Landing" feature of this well-balanced cart will convince you it's the best buy for years of service. Can be furnished with pneumatics, as shown, or steel wheels . . . plain or roller bearings. Write for Catalog.
3 SIZES AVAILABLE:
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Founded 1904 as Sterling Wheelbarrow Co.
MILWAUKEE 14, WIS., U.S.A.
Sterling
WHEELBARROWS
Look for this Mark of STERLING Quality
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Regional Foundry Conference Planned for Syracuse, N.Y.

Plant visitations and technical sessions on sand and patterns feature the program for the Empire State Regional Foundry Conference. The meeting will be held at Drumlin's Country Club, Syracuse, N. Y., Oct. 1-2.

Mornings of both days will be devoted to visits to district foundries. Two seminars will be conducted in the afternoons. One on epoxy resin patterns will be presented by the staff of the Tylene Plastics Co. The second will be a sand seminar presented by the staff of the Harry W. Dietert Co. A concluding general session on Thursday will have T. O. Kuivinen, Cooper-Bessemer Corp., speaking on "What Does the Casting Designer Expect of the Foundryman?" J. G. Kura, Battelle Memorial Institute, will address a Friday luncheon. A banquet is scheduled for Thursday evening.

Don J. Merwin, Orinskany Malleable Iron Co., Orinskany, N. Y., is general conference chairman and R. P. Watson, Chicago Pneumatic Tool Co., Utica, N. Y., is program chairman.

Fenn College Offers Course On Foundry Principles

Fenn College, Cleveland, is offering a practical course (lecture only) on foundry principles.

The course includes a survey of foundries, job potentialities, and geographical and financial situations; theory and solidification of metals; fundamentals of pyrometry and pyrometric practice; sand principles, testing, and control; pattern principles; plaster and investment casting; shell molding; centrifugal casting; permanent mold or gravity diecasting; pressure diecasting; analysis of defects; gating and risering; testing and inspection methods applied to castings; and foundry metallurgy of gray iron, malleable iron, steel, and copper-base, aluminum-base, and magnesium-base alloys.

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Circle 704 on Page 53

This monolithic roof of TAYCOR Ramming Mix is for a 1000-lb. basic direct arc furnace used to melt a variety of heat-resistant alloys. Furnace operates 16 hours daily at temperatures as high as 3400° F. Extensive tests have been conducted to improve roof life for this severe application. The result of these tests proved TAYCOR Ramming Mix lasted *two to three times longer* than any other refractory. TAYCOR roof life varies from a low of 200 heats to a 900-heat record high, depending upon the alloy being melted.

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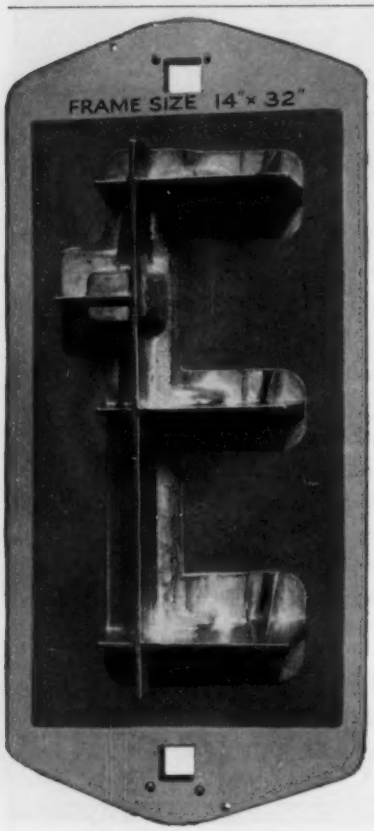

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How Air Pollution Laws Affect Foundry Operation

Many Regulations Are Unreasonably Stringent

By HERBERT J. WEBER
Director
Safety, Hygiene, and Air Pollution Control
American Foundrymen's Society

● MORE AND MORE, the various states are enacting enabling legislation to empower communities to establish air pollution regulations. It is estimated that more than 2000 communities have air pollution laws. To show the impact on the foundry industry of some of the recently enacted and proposed legislation, it is sufficient to review a few salient characteristics of typical laws:

Air Pollution Legislation—Many communities already have adopted or are thinking of adopting the so-called ASME Model Smoke Ordinance and applying its regulations to all types of emissions, even though the ordinance was written for fuel-burning appliances only, such as powerhouse boilers. Part of this ordinance states, "No person shall cause, suffer, or allow to be emitted into the open air from any fuel-burning equipment or premises or to pass a convenient measuring point nearest to the stack outlet, dust in the gases to exceed 0.85 lb per 1000 lb of gases adjusted to 12 per cent CO_2."

Per cent of CO_2 (carbon dioxide) in a stack is a measure of proper combustion of fuel. The higher the CO_2, the better the combustion and the less smoke. If a fuel burning stack has a low percentage of CO_2, incomplete combustion may be occurring, with resulting dense clouds of smoke. Thus the statement "adjusted to 12 per cent CO_2" purposely was written into the model ordinance.

Obviously, the ASME ordinance does not provide sufficient recognition of the difficulties connected with collecting very fine noncombustible particles from metal melting operations. Reduction of visible effluents as recommended in the ASME Model Code requires only efficient operation of the fuel-burning equipment. The expansion of this code to cover metal melting operations never was visualized or

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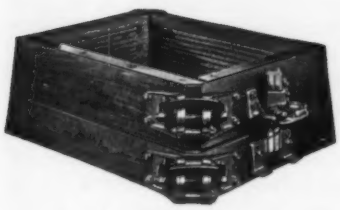
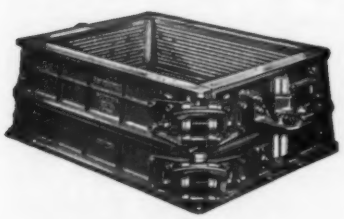


CHERRY EASY-OFF FLASK



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intended when this ordinance was developed. Now let us see what such a law does to metal melting operations:

A neighboring powerhouse stack discharges 0.60 lb/1000 lb of gases with a CO_2 content of 10 per cent. The adjusted emission then is 0.60 × 12/10 = 0.72 lb/1000 lb of gases, which is legal. Thus the power company need not install a collector.

In a cupola melting operation, however, the fuel is a small percentage of the charge, and the CO_2 content of emissions may be of the order of 5 per cent. In an electric furnace, no fuel is used, and the only CO_2 produced is a trace from the slow consumption of the electrode.

Let us say that a cupola discharges 0.50 lb/1000 lb of gases with 5 per cent CO_2. The adjusted emission will be 0.50 × 12/5 = 1.20 lb/1000 lb. The cupola actually is causing less air pollution than the power stack, but a collector would be required under the law. Even more severely, the electric furnace could not discharge more than 0.07 lb/1000 lb of gases without being in violation. This code obviously is unfair to foundries.

Ringelmann Chart—The model smoke law also includes the use of the Ringelmann Chart as the method of measuring the density of smoke, but the Ringelmann Chart is completely inaccurate for measuring a nonblack emission. It was designed originally to measure smoke only since the blackness of a plume is related to the degree of combustion of fuel. Its use to measure the opacity of a nonblack emission such as iron oxide or zinc oxide from metal melting operations never was intended or foreseen.

If the Ringelmann Chart is used to measure the opacity of emissions from metal melting operations, most plants could not comply with a code, even though they met the requirements on the limitations of emissions, unless they installed the highest cost, highest efficiency dust collectors. For a cupola of usual size, such equipment would cost in the neighborhood of $100,000 or more.

Lower cost collection equipment, although performing at an efficiency of 85 per cent, still would emit a visible plume which would not sat-

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Circle 711 on Page 53

isfy the Ringelmann Chart requirements, but might satisfy the requirements for specific emissions limits. If every stack eliminates approximately 85 per cent of its pollution, satisfactory conditions will prevail in most areas. As one approaches a collection efficiency where little or no visible plume is emitted, collection costs rise extremely rapidly.

Furthermore, the use of the Ringelmann Chart for the purpose of evaluating emissions from metal melting operations practically rules out the use of conventional wet collectors, which could meet the emissions limits of most ordinances. Because melting operations are hot (500-1600° F), steam from wet collectors coupled with emission of fines would yield a misleading plume, even though only a small amount of pollution was being emitted.

It is proper, however, to use the Ringelmann Chart for fuel-burning equipment since one need merely adjust the equipment for proper combustion. The Ringelmann Chart is designed to eliminate careless firing of fuels. Thus its use in such a situation imposes no hardship.

Melting Furnaces Differ—In an electric arc furnace, for example, since no fuel is used, no adjustment of combustion is possible. In a cupola or oil-fired furnace, the fuel is such a small percentage of the charge that even with perfect combustion there is a visible non-white emission.

Where the effluent is composed solely of the products of combustion, as in an oil-fired or coal-fired steam boiler, proper combustion yields a white emission (steam) which will satisfy the requirements of the Ringelmann Chart.

Los Angeles County evades the original intent of the use of the Ringelmann Chart by the following subterfuge in wording the regulations: "A person shall not discharge into the atmosphere from any single source of emission any air contaminant of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke of a shade designated as No. 2 on the Ringelmann Chart."

Where an emission is composed of extremely fine particles (less than ½ micron), the ratio of the surface area of the particle to the mass is very large. The mass rate

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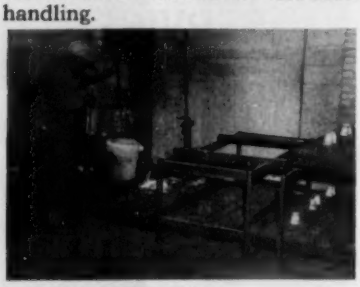

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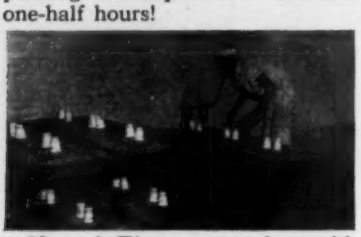

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Circle 713 on Page 53

of emission then is relatively small, but because of light diffraction—as in a Tyndal beam—an emission will appear dense, and the plant will be in violation even though the amount of total solids emitted is insignificant.

Stack Temperature Adjustment—Some communities, such as Detroit, have adopted ordinances which include a stack temperature adjustment and limit emissions to 0.30 grains of particulate matter per cubic foot of gas corrected to 500° F.

This correction to 500° F is suitable for fuel-burning equipment since any boiler having stack temperatures in excess of this amount is not removing heat as efficiently as intended. In the operation of a cupola, however, stack temperatures during melting seldom are lower than 1500° F even when operated efficiently.

Now let us see what this correction does to a cupola. Suppose a powerhouse boiler discharges 0.3 grains/cu ft at 600° F and a cupola discharges 0.3 grains/cu ft at 1500° F. Notice that they both contribute the same amount of air pollution, but discharge at different temperatures.

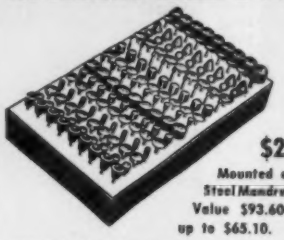
The formula to correct temperature to 500° F is as follows: Air volume × (460 + 500) ÷ (460 + temp of stack). Applying the correction to the powerhouse stack and substituting stack temperature, we get this: 1 × 960 ÷ 1060 or 0.905 cu ft. Then 0.3 grains ÷ 0.905 cu ft = 0.32 grains/cu ft.

Applying the correction to the cupola stack and substituting stack temperature, we get this: 1 × 960 ÷ 1960 or 0.49 cu ft. Then 0.3 grains ÷ 0.49 cu ft = 0.61 grains/cu ft.

Thus the power stack with a minor adjustment in firing practice could meet the requirements of the code. The cupola, on the other hand, while contributing no more to the air pollution would require expensive collection equipment since the correction factor would result in an adjusted discharge double the legal amount.

Oregon Air Pollution Law—Statewide air pollution laws are not desirable because of differences in meteorology and topography from place to place and for other reasons. Air pollution is a local, not a statewide problem. In California, for

144 ABRASIVE WHEELS & POINTS



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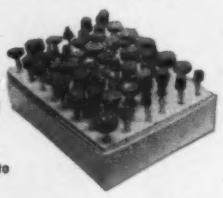

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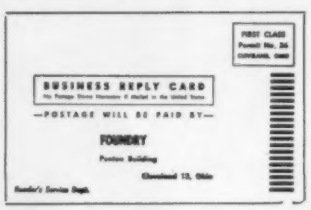

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example, a statewide law adequate for Los Angeles would work an unnecessary hardship on Fresno, and one suitable for Fresno would be inadequate for Los Angeles.

When Oregon enacted a statewide law, it recognized these inequities and decided to evaluate pollution at ground level, where the nuisance is occurring. It is the only air pollution law in the United States which is directed to control air pollution nuisance or damage where it is occurring. The concept is sound because there is no point in collecting emissions from a stack, regardless of amount, if dispersion is good and no nuisance or damage is resulting. Oregon places no limitation on stack emissions.

When Air Pollution Exists

Air pollution is deemed to exist in an industrial area when particle fallout rate exceeds 45 tons per square mile per month above the normal background value or when the suspended particulate concentration exceeds 250 micrograms per cubic meter above the normal background value. If these values are not exceeded, no collection equipment is required by the regulations. Although this law is a commendable attempt at fairness, it is impractical in my opinion for the following reasons:

1. How can one determine the normal background value for a specific area of a city which already is built up without shutting down all sources of emission for 30 days? To extrapolate findings in a nondeveloped area to one already developed has no scientific basis.

2. To date, researchers in the field have been unable to find any correlation between specific stack emissions and particle fallout. In other words, how can one determine from particle fallout in a given area what stacks should have dust collectors and how efficient they must be?

3. When collection equipment is required, what will be an acceptable emission? Unless definite limitations on stack emissions are fixed, the law is subject to capricious enforcement. The degree of control required can vary with the varying opinions of inspectors.

4. Most important, when one spends $30,000 to $125,000 for control equipment, he naturally wants

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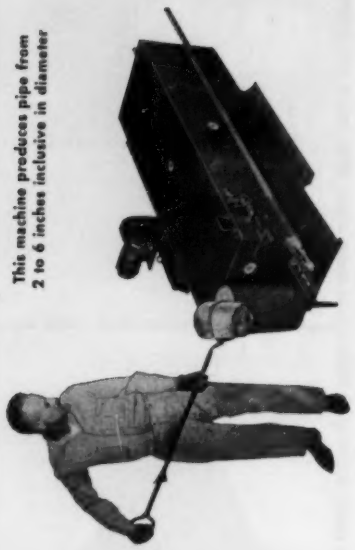

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a guarantee that the equipment will satisfy the authority. Manufacturers of dust collection equipment cannot, on the basis of the Oregon law, give a guarantee since they cannot thereby guarantee a decrease in area particle fallout.

It seems to me that on any test case, the courts will find that the law is unconstitutional since it is so vague and uncertain that it fails to prescribe an ascertainable standard of guilt and is therefore a denial of due process of law. Efforts to change this law on an engineering level have failed. The only recourse now open to foundrymen is to file an *amicus cureae* brief to obtain a court ruling on the constitutionality of the regulations.

Los Angeles and Vancouver—The jurisdictions in Los Angeles County and Vancouver, B. C., base the amount of allowable emission on process weight per hour for industrial processes not classified as combustion processes. Although this method of fixing emissions limitations has been severely criticized, I see nothing intrinsically unsound in it. It does not favor one type of industrial process over another as some ordinances do by penalizing emissions resulting from processes other than combustion of fuel.

In the case of combustion processes, Los Angeles County sets a limit of 0.4 grains per cubic foot of effluent at standard conditions and adjusted to 12 per cent CO_2.

Originally the Vancouver by-law allowed 0.45 grain per cubic foot of gases corrected to 68° F and adjusted to 12 per cent CO_2, but these limitations applied to all industrial process. It also followed exactly the Los Angeles County Ringelmann Chart prohibitions. The by-law since has been revised.

It would seem that critics of the method confuse the philosophy with the severity. Actually this method of fixing emissions limitations can be severe, reasonable, or lenient.

Bay Area Air Pollution—Apparently California has learned some lessons from the Los Angeles County air pollution experience, because the law establishing the Bay Area air pollution control district specifies the following condition:

"If the hearing board finds that because of conditions beyond control, compliance with any rule, regulation, or order of the air pollution

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Circle 718 on Page 53

control board will result in an arbitrary and unreasonable taking of property or in the practical closing and elimination of any lawful business, occupation or activity, in either case without a sufficient corresponding benefit or advantage to the people in the reduction of air contamination, it shall prescribe other and different requirements, etc.—provided, however, that no variance may permit or authorize the maintenance of a nuisance."

Allegheny County Ordinance — Allegheny County in its July 12, 1955, revision of the Smoke Control Ordinance recognized the unfairness of other jurisdictions with respect to steel mills and foundries and specifically exempted mills, nonferrous foundries, cupolas, electric furnaces, etc., from the application of the Ringelmann Chart to emissions and from the limitations imposed by the correction factors for CO_2 and temperature.

The law qualifies the exemption by stating that any person responsible for the operation of electric furnaces or nonferrous foundries shall participate in a program of research to determine practical means for controlling emissions from such furnaces or nonferrous foundries.

The authority recognized the difficulty in controlling emissions from nonferrous foundries. Hence the law reads as follows: "All nonferrous foundry plants shall incorporate those means of controlling emissions of smoke and fly ash to the atmosphere which have been found to be economically practical."

The Allegheny County Ordinance is an example of a co-operative ap-

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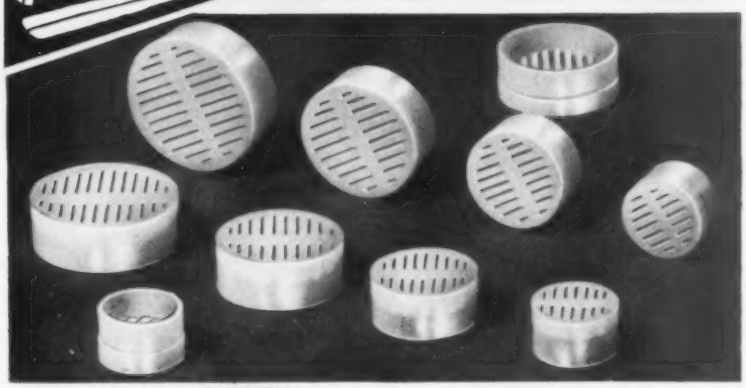

SAVE TIME and MONEY with one standard Non-Clogging Vent for All Blowplates and Core Boxes.

- Out lasts metal vents 3 to 1.
- Acid, Oil and Steam resistant.
- Easily and quickly contoured to shape of box.

Samples on request... Phone, Wire, Write Today!

RONSON industries A Division of Monarch Products Corp.
INterocean 8-7700
110-120 EAST 115th STREET • CHICAGO 28, ILLINOIS

Circle 720 on Page 53

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SPINCRAFT LADLES

Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

- LIGHT IN WEIGHT LESS FATIGUE!
- NON-SPILL SHAPE NO WASTE!
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Write Today for Complete Data and Prices.

Spincraft
SKILL WILL DO IT
INCORPORATED

4124 WEST STATE STREET
MILWAUKEE 8, WISCONSIN
Division 2-0730

Circle 721 on Page 53

proach recognizing the problems of industry. It should be noted that the intent of Allegheny County was not to impose regulations on certain operations for which, at the present time, there is no practical method of control.

SFSA Announces Winners in 1959 Safety Poster Contest

The Safety Committee of the Steel Founders' Society of America selected four winning posters out of 212 submitted in the 1959 Safety Poster Contest for national honors.

The winners are Charles W. Hunt, Oklahoma Steel Castings

E. J. Conroy C. W. Hunt

Mrs. Reisenberg T. S. Emala

Co., Tulsa, Okla.; Thomas S. Emala, American Steel Foundries at the former Verona, Pa., plant; Edward J. Conroy, Electric Steel Foundry Co., Portland, Oreg.; and Mrs. Clare Riesenberg, Sawbrook Steel Castings Co., Lockland, Ohio, who also was a winner in 1957.

The winners receive a certificate of recognition from the society, and the selected posters were reproduced in large size for display during the recent annual Steel Foundry Safety Contest. This contest runs during the months of June, July and August each year. During the contest these winning posters are displayed in all plants of SFSA mem-

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Circle 722 on Page 53

Cut casting costs, eliminate shrinkage, reduce scrap with

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exothermic anti-piping compounds for increased feeding efficiency

This bulletin tells you how. Send for your free copy today.

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Circle 723 on Page 53

bers. Other posters are selected for display during the remaining eight months of the year as a means of maintaining permanent awareness of good safety habits in the industry.

Plan Pittsburgh Conference on Chemistry and Spectroscopy

The 11th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, sponsored by the Analytical Chemistry Group, Pittsburgh Section, American Chemical Society, and the Spectroscopy Society of Pittsburgh, will be held at the Penn-Sheraton Hotel, Pittsburgh, Feb. 29-March 4.

Several symposiums are planned, and papers are invited in all fields of analytical chemistry and spectroscopy. The exposition of chemicals and equipment will be enlarged again and will include nearly 100 exhibitors.

Oct. 15 is the deadline for titles and abstracts for papers. Inquiries and correspondence regarding papers should be directed to the program chairman, James E. Patterson, Pittsburgh Conference, Jones & Laughlin Steel Corp., Graham Research Laboratory, Pittsburgh 30, Pa.

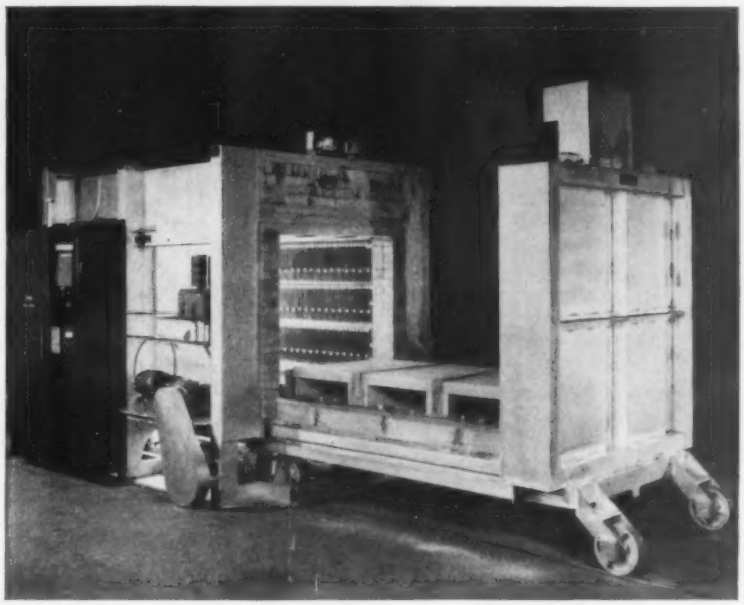
ICI Publishes Proceedings Of 1959 Western Meeting

Proceedings of the technical session held during the Investment Casting Institute's Western Meeting at Santa Monica, Calif., last March have been published by the institute.

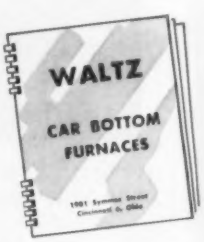
Contents include "Inspection Techniques of First Articles and Production Parts," Rudy Iglesias, Convair Div., General Dynamics Corp.; "Producibility," John Workman, Convair Div., General Dynamics Corp.; "Evaluation of Investment Castings for High Temperature Applications," Earl Campbell, AiResearch Mfg. Co.; "Development of Investment Cast Rifle Chambers," T. N. Thys, Precision Founders Inc.; and "Investment Castings in Prototype Development," A. J. Ilker, Northrop Aircraft Inc.

The proceedings can be obtained from Investment Casting Institute, 27 E. Monroe St., Chicago 3, Ill., at $5 a copy.

LOOK . . . no rails needed and installation costs cut when you buy this new Waltz furnace



This new WALTZ electric car bottom furnace, 3' wide x 3' high x 6' long, completely eliminates expensive installation of rails, etc. It is in wide usage in plants where heat treating facilities are above the first floor. Rigid and sturdy construction gives years of usage. Ball bearing wheels for easy operation. Furnace has 12" lining of insulation, heating elements on side walls, rear wall, door, and top of car. Many other typical Waltz features make this special car bottom furnace a wise investment. All technical details, etc., are included in an illustrated 33 page book available free on request.



Waltz Furnace Company
Dept. E, 1901 Symmes St., Cincinnati 6, Ohio
Please send me without obligation this new 33 page illustrated book, with photos and technical description of this furnace and 13 other WALTZ car bottom furnaces.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

Waltz FURNACE COMPANY
Symmes Street • Cincinnati, Ohio

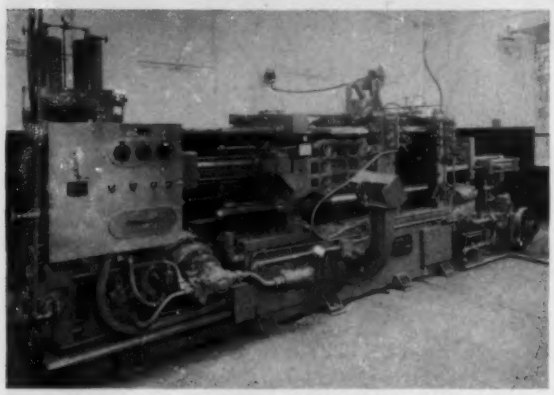
Circle 724 on Page 53

The Shakeout

Diecasting Machines Feature Improved Designs

RESEARCH in diecasting machine engineering, with emphasis on automation and vacuum diecasting, is conducted at the Die Casting Development Center, Cleveland Automatic Machine Co., Cincinnati.

Development work in automation is carried out on a



Model 50 zinc machine, which has a 50-ton die locking pressure. Fully automated, it operates at better than 500 shots per hour with a four-cavity die. It is equipped with an automatic casting ejection and conveying system.

A Model 400-N aluminum machine (illustrated) has a 400-ton die locking pressure. A single-cavity for an extremely thin-walled part is evacuated by vacuum (Morton system) before each shot is made, and vacuum is utilized for automatic ladling.

For More Details Circle No. 517—Page 53

Ships Foundry Products Via Seaway

OPENING of the St. Lawrence Seaway this spring has made ocean ports of cities on the Great Lakes. The Swedish vessel shown here left Milwaukee May 21 with

cargo which included 75 drums of products of Delta Oil Products Corp., Milwaukee, destined for Sweden.

That shipment marked the start of a stepped up export sales program timed to coincide with the opening of the Seaway. Future shipments will go the all-water route to any country whose ships dock at Milwaukee.

For More Details Circle No. 518—Page 53

Studies Aluminum Bearings for Journal Boxes

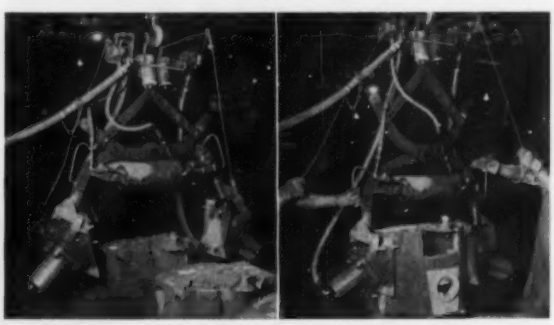
AUTHORIZATION to test and run aluminum bearings in journal boxes on 100 captive railroad freight cars has been granted Aluminum Co. of America by the Association of American Railroads. Alcoa will produce the bearings in 750-T5, a special Al-Sn alloy.

It is hoped that the tests will provide the answer to what railroaders consider their greatest single maintenance problem—"hot-box" damage. A hot box results when insufficient lubricant reaches bearings. In extreme cases, heat and friction melt or wear through the Babbitt lining and cause breakage of the axle. In the view above, D. B. Wood, Alcoa bearing expert, holds up one of the first bearings cast for the tests.

For More Details Circle No. 519—Page 53

Shakeout Time Is Reduced Almost 85 Per Cent

AN UNUSUAL but highly effective and cost-cutting method of shaking out firepot sand castings at Weil-McLain Co., Michigan City, Ind., boiler and radiator



manufacturers, has cut the time required from 3 minutes to 30 seconds. In addition, it eliminates danger of falling castings, ends casting breakage, and reduces air consumption and maintenance costs.

Freeing castings of sand formerly required the use of vibrators and a wooden maul, with frequent breakage and time losses. The new method features the use of two 4-in. KO boltless vibrators made by Cleveland Vibrator Co., Cleveland, Ohio.

For More Details Circle No. 520—Page 53

You get MORE with

MOROC®

the controlled silicate CO_2 binder

MORE SPEED. Curing time ranges from ten seconds to three minutes, depending on type of mold or core.

MORE LABOR SAVING. Cores are ready for use when they come from core box. You eliminate movement to and from ovens, handling of core driers, cementing of halves.

MORE FLEXIBILITY. Fast curing means faster handling of rush orders. There's no need to stockpile cores for future orders. You have the flexibility to meet customer needs on schedule.

MORE PROFIT. With MOROC you can get this extra capacity and flexibility with a smaller investment in equipment than would be required for additional ovens or shell-molding equipment.

MOROC COMES IN FOUR GRADES

MOROC 1. High-strength binder.

MOROC 2. High-strength and good collapsibility.

MOROC 3. High-strength and high collapsibility to meet demands of core-blowing equipment.

MOROC 4. Extra-high collapsibility and good flowability.

Write for complete information. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals®

Circle 726 on Page 53

ACCURATE RESULTS ASSURED with Combs Gyratory Riddles

"Greatest Name in Motion"

TYPE "CS". Complete price $395.00. 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ¼ H.P. enclosed motor.

TYPE "CR". Complete price $385.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., 1/3 H.P. enclosed motor.

TYPE "HL". Price $285.00 complete, less sieves. Laboratory model especially designed for laboratory sand control, fitted with 1/6 H.P. enclosed motor.

PROMPT DELIVERY from your Foundry Supply House

TYPE "V". Price, 20" Sieve, $300.00. Does the work of 10 men. Screens sand, Fine, Medium, and Coarse. 20" dia. sieve with special clamp for 5-second changes. Height 4'6", weight 100 lbs., fully-enclosed 1/6 H.P. motor. Also available in Giant V-5 with 36" sieve for triple capacity . . . Price $545.00.

MAIL THE COUPON NOW!

GREAT WESTERN MFG. CO.

Leavenworth, Kansas Phone MU-22291

☐ Send Additional FREE Information

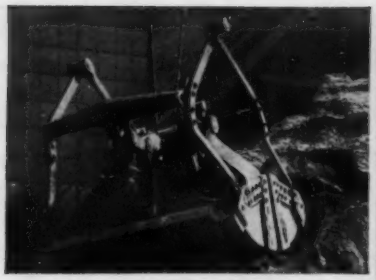
NAME

ADDRESS

CITY STATE

Circle 727 on Page 53

Blaw-Knox single line type buckets improve foundry handling operations



Unusually low headroom requirements are provided for by the application of symmetrically designed, extremely low headroom types of single line buckets.

Blaw-Knox single line, hook-on type foundry buckets are especially designed for efficient operation under all types of headroom conditions. In addition, their quick—detachable feature permits the bucket to be released instantly, freeing the crane for other duties. Special shark-tooth types are available for handling coke with a minimum of degradation.

Blaw-Knox sales engineers can study your requirements and apply the bucket best suited to your needs.

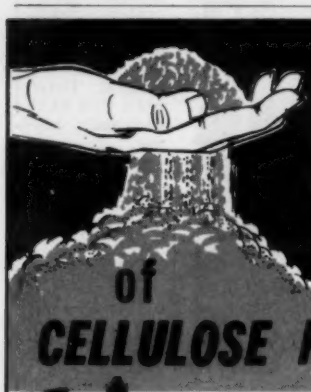
Normal headroom usually accommodates standard Blaw-Knox Foundry Buckets of either the open head or closed head types.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

BLAW-KNOX

Circle 728 on Page 53



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FOR THE METROPOLITAN **NEW YORK AREA**

Buy direct these two quality cellulose products at substantial savings from one of America's leading processors. No more large inventories or heavy freight charges for foundries within 200 miles of New York City.

MAIZE--X

Precisely ground from corn cobs. Provides maximum flowability with uniform hardness — reduces scabs and buckles. Gives superior shakeout with increasing collapsibility.

WOOD--X

100% maple woodflour of uniform texture with controlled moisture content. Gives decreased hot strength at 1000° F. Substantially increases core-gas volume and green compression strength of sand.

Test the exceptional performance of these two products in your own foundry by writing for Free Samples today.

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A NEW COST MANUAL (NO. 2) *for the Gray Iron Castings Industry*

Here in 120 carefully planned pages is a complete Cost Account System for both a small foundry with minimum accounting facilities and a large foundry capable of detailed cost determinations for accuracy and completeness.

Price $10.00 Postpaid

Two cost manuals under one cover—Cost Manual No. 1, representing twenty years of editing and revising by practical operating experts in the industry, is included as a supplement.

The more thorough treatment of the subject found in the new manual was dictated by the considerations of economy in dealing with the higher priced labor and material factors and a relentless desire to probe for hidden costs from wasteful and nonprofitable activities.

GET YOUR NEW COMPLETE COST SYSTEM FOR FOUNDRIES

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Please forward one copy of COST MANUAL NO. 2, at $10.00 postpaid. ☐ Check enclosed.

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Circle 729 on Page 53

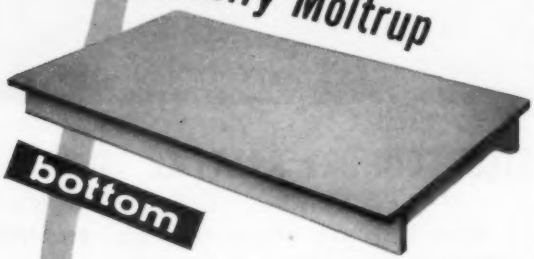
Circle 730 on Page 53

for **plates**

... that stay flat

... and last longer

... specify Moltrup



For accurate casting results specify Moltrup Plates. They are long-lasting and stay flat — because Moltrup employs a special flattening process designed to permanently eliminate buckling or bending. Consequently your investment goes further and your profit margin increases. Plates are made to your specifications. Write or phone us for complete information.

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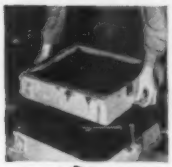
New York, N. Y. Syracuse, N. Y. Cincinnati, O.
Cleveland, O. Los Angeles, Calif.

F-2

Circle 731 on Page 53

When casting Aluminum



or Magnesium

Improve product and process with B&A® ALKALI FLUOBORATES and Potassium Titanium Fluoride

As a purifying flux in aluminum casting, B&A Potassium Fluoborate removes oxides . . . acts as degassing agent . . . forms a dry dross . . . improves fluidity of the molten metal. Subsequent treatment with B&A Potassium Titanium Fluoride, or a mixture of Potassium Titanium Fluoride with Potassium Fluoborate (for lower melting temperatures), produces better grain structure . . . with increased tensile strength, greater elongation, better machinability, and other benefits stemming from improved grain.

In magnesium casting you can reduce rejects by using the Alkali Fluoborates as oxidation inhibitors with both green sand and core sand. Cores are easier to make. They collapse faster. They're easier to shake out.

Write today on your company letterhead for further information, test samples, technical assistance.

BAKER & ADAMSON® Fine Chemicals

Allied Chemical

GENERAL CHEMICAL DIVISION

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GLUTRIN
LIQUID BINDER

GOULAC
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For

CORE WORK, SAND FACINGS, SPRAYS

Write for pamphlets giving detailed information. Both materials carried in stock by America's foremost foundry jobbers

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(Established 1905)

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HARTLEY Controls CORPORATION • NEENAH • WISCONSIN

Originators of Fully Automated Sand Systems for Foundries

■■■ Full details will be sent promptly on complete systems • Sand Controls • Moisture Controls • Mixer Timers • Bond Feeders • Bin Controls • Mixer Selectors • Pneumatic Transporters

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STEEL FOUNDRY PRACTICE

By John Howe Hall

496 PAGES 6x9 CLOTH BOUND PRICE $12. POST PAID

This book contains practical information on almost every production problem steel foundrymen encounter. The easy-to-read text is accompanied by over 250 detailed charts, drawings and illustrations. ★

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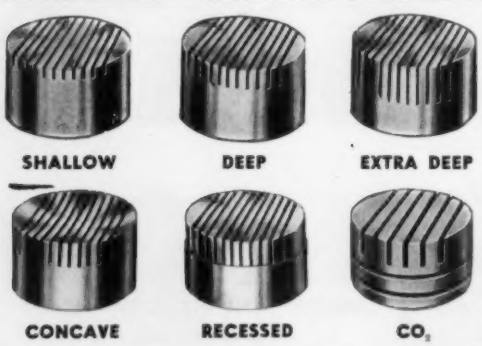

Slotted core box vents for every purpose. Inserting drill (right) ideal for inserting core vents. Special cleaning tool saves time.

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Pressure Cast

MATCHPLATES

HOLDS LIKE A VISE TO PREVENT MOLD SHIFT* FROM CONVEYOR LINE JOLTS OR ROUGH HANDLING

WHY NOT SAMPLE TEST THEM ?

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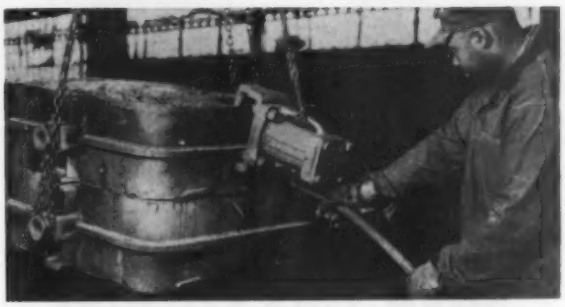
Circle 737 on Page 53

NEW!



NAVCO FLASK-RAPPER AIR VIBRATORS

for "Fast Shake-Out" of Flasks and Pots

Navco's new FR Vibrators are designed for rapid "shake-out" cleaning of flask or pots and general knock-out work.

Have Navco's patented one-piece construction with piston the only moving part. Operation is virtually "maintenance-free". Operate on 35 to 65 PSI.

Model FR3 weighs 74 lbs., has 3" piston. Model FR4 weighs 115 lbs., has 4" piston.

Write for Catalog 304 showing details and specifications of Navco "One-Piece" Sand-Hopper Vibrators.

NATIONAL AIR VIBRATOR CO.

435 Literary Rd., Cleveland 13, Ohio

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PENN BUCKETS

Careful balancing makes Penn Buckets self dumping when loaded and self righting when empty. Welded construction prevents "clinging" makes them empty easily and completely.

WRITE TODAY FOR NEW BULLETIN AND DIMENSION SHEET

No. 4-A
Self-Dumping

PENN IRON WORKS, INC.

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NEW... meets every industrial need!

Rotary Compressors

Stationary units . . . 20 to 125 h.p. @ 125 p.s.i.

- ✓ Silent . . . vibrationless . . . compact
- ✓ Complete line . . . 2 to 125 h.p. . . . 8 to 500 c.f.m. @ 125 p.s.i.
- ✓ No complicated engineering . . . no compressor room . . . no foundation
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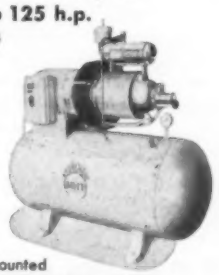

Tank mounted
2 to 5 h.p. @ 100-200 p.s.i.

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INDUSTRIAL DIVISION

DAVEY pioneers of air-cooled air

DAVEY COMPRESSOR CO.

Kent, Ohio

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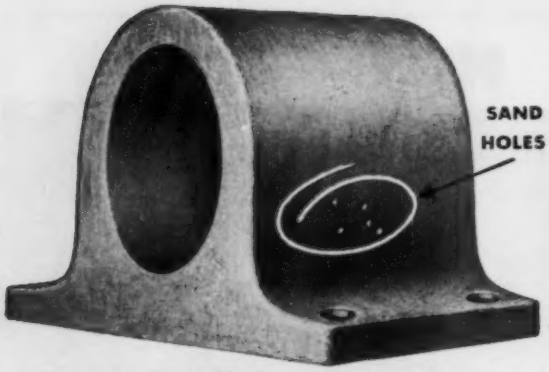

Save This Casting *with* SMOOTH-ON FOUNDRY CEMENTS

Often a perfectly good casting has blow or sand holes, surface blemishes, or rough and porous areas that detract from its appearance. But there's no reason why it can't *look* as good as it really is.

Simply use Smooth-On Foundry Cement. It goes on easily, quickly . . . hardens rapidly at a predictable rate . . . stays firmly in place.

SHADINGS TO MATCH ANY CASTING

4A - Medium Gray
4AA - Light Gray
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Quality Control That Assures You of Tight, Lasting Repairs

Every lot of Smooth-On Foundry Cement is laboratory tested for setting time, hardness and color. You can be sure of tight, lasting, good looking results every time, provided the directions are followed.

See how much better your castings will look after treatment with Smooth-On, known and used by leading foundries for more than 63 years. Try one or more of these cements at our expense. Write today—on your business letterhead—and we will send you free samples.

SMOOTH-ON MANUFACTURING CO.
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FREE SAMPLES

80-390

SMOOTH-ON FOUNDRY CEMENTS

Circle 741 on Page 53

Save Money *with* RUDOW STRAINER CORES

Custom Made • Will Duplicate Your Sample or Drawing • Unlimited Design Range • High Heat Resistance • Extra Hard • Saves Time—Trouble

RUDOW quality Strainer Cores cut rejects, cut costs, keep castings free of oxides, slag and impurities—simplify gaiting control and metal flow, for greater production. We offer you Free Samples of RUDOW Strainer Cores—made like your sample, or from your drawing. Write today—or phone MAin 6-1163.

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Circle 743 on Page 53

FOUNDRY

EDWIN S. CARMAN, INC.
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CLEVELAND 18, OHIO

A COMPLETE FOUNDRY SERVICE

MECHANIZATION

Circle 744 on Page 52

CLASSIFIED ADVERTISING

Help Wanted

METALLURGIST

A Wisconsin gray iron foundry requires an engineer to fill the position of assistant to its Chief Metallurgist. A recent graduate is preferred, although consideration will be given to anyone who has foundry metallurgical experience. Knowledge of cupola operations is also desirable.

Company is a leader in its field, with modern metallurgical facilities and progressive methods. A fine opportunity for the young man who is seeking to improve himself.

Please provide complete background in first letter, including references, and salary desired.

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CLEANING ROOM FOREMAN

Light production, gray iron foundry located in Chicago area producing approximately 40 tons of castings daily, requires man experienced with cleaning and grinding operations. Must have ability to handle and train help. Excellent opportunity in a progressive organization for one that is qualified. Submit full particulars.

BOX 673, FOUNDRY
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SAND CONTROL TECHNICIAN

Experienced in both natural and synthetic sands for use in gray iron foundry, located in the Chicago area producing light and medium size castings. Exceptional opportunity in a progressive organization for qualified individual. Submit full particulars regarding personal data and experience.

BOX 672, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGIST

B.S. degree Metallurgical Engineering required. Must have had several years experience in gray iron foundry, and be thoroughly versed in cupola operation and qualified to head Melting Department in a large mechanized foundry. Midwest location. Submit complete resume on education and experience, also salary requirements. All replies held in confidence.

BOX 685, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

GENERAL MOLDING FOREMAN

Wanted for production malleable foundry. Address: Box 650, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOREMAN

Well experienced in making centrifugal castings. Prefer man 25 to 35 with some technical and metallurgical training willing to work with pouring crew, gradually assuming foremanship. Opportunity for energetic, capable person with organizing abilities to advance to superintendent, of well established foundry on Pacific Coast. Address: Box 652, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Experienced in steel foundry. Midwest area. Good opportunity for right person. Address: Box 662, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN—STEEL FOUNDRY

Career opportunity for man experienced in supervising molding of high quality carbon and alloy steel pressure containing castings ranging from several pounds to 5 tons. Electric arc and induction melting facilities. Position requires experience as journeyman molder, preferably in steel castings. Benefits above average. Send full resume of qualifications with recent photo if possible. All replies treated confidentially. Address: Box 668, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOREMAN

Jobbing steel foundry needs molding foreman. Must know heading and gating. Excellent opportunity for advancement. Address: Box 625, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SALESMAN—GRAY IRON CASTINGS

New Jersey foundry and machine shop equipped for finished castings from 10 to 10,000 pounds. Excellent opportunity with old, well established company. Should have good sales connections. Several good territories open in East and Middle West. List area you now cover. Submit complete resume on education, experience, salary requirements, etc. All inquiries held in strictest confidence. Address: Box 665, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Help Wanted

SUPERINTENDENT—GRAY IRON FOUNDRY

Good salary, plus profit incentive, to man who can satisfactorily operate a very modern, gray iron foundry. Well established, growing organization, presently employing about 75 people. Located in Cincinnati area. Write, stating why you feel qualified, to:

BOX 660, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY SALES

Gray iron, ductile, shell molding, CO_2 facilities. Metallurgical background preferred. Salary, plus bonus and expenses. Car furnished.

CENTURY FOUNDRY
ST. LOUIS 10, MO.

SUPERVISOR

For Steel foundry in Ontario. Must be experienced in steel molding and know the acid electric practice.

BOX 642 FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

CUPOLA FOREMAN

Experience required in all operating phases. Repair, relining and rebuilding essential.

CENTURY FOUNDRY
ST. LOUIS 10, MO.

MOLDING SUPERVISOR

Large eastern jobbing foundry wishes to secure the services of an experienced Molding Supervisor. Good opportunity, many benefits. All replies held confidential. State salary requirement and all pertinent facts.

BOX 633, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ASSISTANT TO METALLURGIST

To work in melting, sand control, heat treatment, etc. State experience and salary expected. Mid-West Malleable Iron Foundry. Address: Box 675, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GENERAL FOUNDRY FOREMAN

Thoroughly versed in green sand molding and production procedures, pouring, gating and risering and scrap reduction. Must be able to get along well with people. Excellent salary along with company paid benefits—good opportunity for a qualified man. Mechanized malleable iron foundry located in Midwest. Enclose resume, references, experience, etc. Address: Box 653, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ENGINEER—MECHANICAL

Foundry experience desired. Work in plant layout, material handling, fixture and die design, special machinery design, process development. Degree desirable. Give details and salary expected. Midwest location. Address: Box 674 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Must be well versed in all phases of permanent mold and sand casting of aluminum. Prefer man with technical as well as practical experience. Write giving qualifications in detail and salary requirements. Address: Box 637, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

Experienced brass foundry Superintendent capable of taking complete charge of all foundry operations making small cored pressure castings. Foundry located in large industrial N. C. city. Excellent opportunity for right man. Advise full particulars. Address: Box 635, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Help Wanted

PLANT ENGINEERS

Experienced on layout of all types of foundry equipment, material handling and material flows. Send complete details on work history, education and family status. Include recent photograph. All replies confidential.

BOX 655 FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

METALLURGIST

Progressive young aluminum and brass foundry in the east, desires the services of metallurgist familiar with sand and permanent mold foundry operations, run analysis and assist foundry manager. Send complete resume and advise salary expected.

BOX 623, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRYMAN

With engineering and metallurgical background. Experienced in shell molding and CO_2 process, to head shop. Send complete resume to:

BOX 678, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOREMAN

For medium sized Aluminum Sand foundry. Must be practical man who understands all phases, able to produce quality castings and be cost conscious. Good salary, profit sharing. Southern Connecticut.

BOX 687, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOREMAN

For small gray iron jobbing foundry in Southeast. Know cupola operations and sand control. Send brief resume and salary requirements. Address: Box 682, FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Thoroughly versed in all phases of production including shell molding of small stainless steel, monel, stellite and ductile iron castings of aircraft quality. Prefer man with metallurgical background and years of practical experience. Must know induction furnace melting. Excellent opportunity for ambitious, energetic person to develop a new division of a well established foundry in California. Address: Box 651, FOUNDRY, Penton Bldg., Cleveland 23, Ohio.

CORE ROOM FOREMAN

Steel foundry. Experienced carbon and stainless steel castings up to 2000 #. Quality production—valves, pumps, etc. CO_2 and special sands. Located Eastern Pa. Address: Box 632, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY FOREMAN NONFERROUS

Growing electrical manufacturer located in the Southeast seeking foundry foreman with five to ten years experience in nonferrous foundry operations. Prefer experience in casting small repetitive type products. We offer excellent salary with Company paid benefits and growth opportunity. Our employees know of this ad. Please send complete professional and educational resume to: Box 670, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SERVICE METALLURGICAL ENGINEER—NONFERROUS

Opportunity for nonferrous metallurgist interested in customer technical service and development work. Applicant should be familiar with aluminum alloys manufacture and use. Knowledge of titanium alloys desirable. Degree desirable. Salary open. Apply H. S. Schaufus, Chief Metallurgical Engineer, Vanadium Corporation of America, Research Center, Cambridge, Ohio.

Help Wanted

METALLURGIST—SAND SPECIALIST

Unusual opportunity for man thoroughly familiar with latest developments in sand and metallurgical practices for automotive and farm implement gray and malleable iron castings. This is an overseas assignment. Send complete information, in confidence, on education, work history including earnings record and personal data. Include small, recent photograph. Address: Box 638 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

COREROOM FOREMAN

Wanted for production malleable foundry. Address: Box 649, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SERVICE METALLURGICAL ENGINEER—STEEL MELTING

Attractive opening for metallurgical service engineer to do liaison work between Technical Center and customer steel plants dealing with carbon and low alloy steels. Applicant should have melt shop experience. Opportunity to participate in technical and research developments and commercial trade problems. Metallurgical Engineering degree desirable. Salary commensurate with qualifications and experience. Apply to H. S. Schaufus, Chief Metallurgical Engineer, Vanadium Corporation of America, Research Center, Cambridge, Ohio.

MAINTENANCE ENGINEER

Wanted by foundry located in central Indiana. In addition to usual mechanical training and experience must have some experience in electrical work. Must be able to read and understand electrical schematics. This is not an executive position but will require much work in the plant. M.E. or E.E. degree preferred but practical experience more important. 3-5 years foundry experience desirable, age 25-50, salary open. Enclose resume, references, salary desired in first reply. Address: Box 628, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Representatives Wanted

JOBBERS WANTED

We manufacture Kob-Kleen (ground corn cobs) for deburring, burnishing, polishing and soft grit blasting of metals, metal stamping absorbants, etc. Nationally advertised.

COEVAL, INC.
DEPT. H ST. JOSEPH, ILLINOIS

Positions Wanted

FOUNDRY ENGINEER

WITH SOUND TECHNICAL AND PRACTICAL BACKGROUND IN ALL PHASES OF FERROUS OPERATIONS DESIRES POSITION IN PROGRESSIVE COMPANY AS SUPERINTENDENT OR ASSISTANT SUPERINTENDENT. AGE 37. EMPLOYED. ADDRESS: BOX 684, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

SUPERINTENDENT OR MANAGER

Practical and technical background of 32 years in all phases gray iron operations (Meehanite experience), 17 years superintendent. Age 50, good health. Desire position Mexico, South America. Now employed. Address: Box 618, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Graduate Metallurgist—presently employed as Chief Metallurgist in charge of melting, inspection and quality control. Experience also includes sand control, molding and foundry sales. Desire position with progressive gray iron foundry. Address: Box 683, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Graduate. Eight years experience in gray iron on sand control, melting, foundry metallurgist and superintendent. Interested in obtaining position with medium or small foundry. Now employed. Will relocate anywhere. Address: Box 646, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGER—AIRCRAFT QUALITY CASTINGS

Young, aggressive, metallurgical engineer, desires new connection at top management level. Thoroughly experienced in all phases, technical and management of lost wax, ceramicast, waxshell processes. Address: Box 679, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Representatives Wanted

MANUFACTURER'S REPRESENTATIVES
Molding Machines • Core Blowers

Leading manufacturer of molding machines and core blowers is searching for established manufacturer's representatives now engaged in sales and service to foundries in Texas, Louisiana, Oklahoma, and adjoining areas.

This is an advanced, complete line of quality foundry machinery and a thorough knowledge of foundry methods and machinery application is essential.

Exclusive representation is guaranteed by manufacturer. There is no objection to parties handling other non-conflicting foundry lines.

Send complete resume—current representation, experience, principals, qualifications, etc. All replies shall be held confidential.

BOX 656, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SALES REPRESENTATIVES

Here is an established competitively-priced line you can count on for a good income. Milward Alloys, a leading manufacturer with a strong reputation is now in the process of localizing many sales areas to give better service to customers and prospects from coast to coast. A considerable number of territories are open. We need men who will take them on, full or part time.

You may now be serving the trade or you may have foundry experience. Maybe you're retired with time on your hands. Regardless of your situation, you will be amply rewarded—because Milward's line is broad and in constant demand. Milward alloys cut foundry costs. Orders are promptly filled. That's why we have a substantial reorder business.

The Milward line includes: copper shot; phosphor copper and other powerful deoxidizers and degasifiers; aluminum bronze and manganese bronze hardeners and ingots; copper silicon, copper manganese, copper iron, copper aluminum and copper chrome alloys; nickel copper and nickel iron alloys; aluminum titanium, aluminum silicon, aluminum manganese, aluminum iron and aluminum copper and other alloys.

Phone or send us a letter describing the area or locality you can cover, whether full or part time, and tell us a little about yourself . . . your qualifications, experience, and when available. This may well be the connection you've been waiting for. Write or phone: Mr. David B. Milward, President. Phones: Lockport, N. Y. 4-0435, or Buffalo, N. Y. LUdlow 6425.

MILWARD ALLOYS, INC.
Lockport, N. Y.

Positions Wanted

FOUNDRY SUPERINTENDENT

Capable of handling complete foundry operations in carbon steels-heat and corrosion-resisting, shell, CO_2, centrifugal casting, shot process. Address: Box 622 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Progressive foundry man with 16 years experience as foundry Superintendent, finishing Superintendent, and Industrial Engineer in both malleable and steel would like to make change. Consider sales, operating or consulting. Prefer small organization. Address: Box 636, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT—MANAGER

21 years as Superintendent and Manager of ferrous and nonferrous jobbing and production foundries. Sales and metallurgical background. Practical and technical experience. Age 48. Address: Box 667, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER

Progressive foundryman familiar with every phase of practical experience on all classes of work. Now employed. Would like to make change. Address: Box 663, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

TRAINED STEELMOLDER

German, living in Canada, age 22 with seven years in various types of steel molding, seeking new connections. Prefer jobbing foundry. Willing to locate anywhere. Address: Box 627, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

Practical and technical 30 years' experience jobbing and production. Familiar with every phase of the foundry. Now employed. Address: Box 677, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANUFACTURERS' REPRESENTATIVES

Affiliation sought—well established, expanding New England foundry with full facilities for manufacturing gray iron, brass and aluminum castings, invites financially attractive contact with manufacturer representatives.

BOX 680, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SALES REPRESENTATIVE

Foundry supply company requires services of Sales Representative to call on accounts in western New York and western Pennsylvania to sell supplies and equipment. Excellent opportunity for man with foundry experience and sales ability. Prefer man not over 40 years of age. Include recent photograph. All replies held in strict confidence. Address: Box 639, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANUFACTURERS' REPRESENTATIVES—GRAY IRON CASTINGS

Well established expanding Eastern foundry and machine shop. We make castings from 5 to 10,000 pounds. We can compete West to Miss. River. We desire top flight Reps. with good sales connections who regularly cover buying sources. Please state area you cover, manufacturers you represent, size of your organization, etc. Address: Box 666, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANUFACTURERS' REPRESENTATIVE

Well established, expanding Michigan foundry with full facilities, manufacturing gray iron, brass and aluminum—sand and plaster mold castings seeks affiliation with Manufacturers' Representatives. Address: Box 644, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Positions Wanted

FOUNDRY EXECUTIVE

SOUND TECHNICAL AND PRACTICAL BACKGROUND IN FERROUS CASTINGS. EXCELLENT SALES AND ADVERTISING MANAGEMENT RECORD. INTERESTED ONLY IN AGGRESSIVE GROWTH COMPANY. DESIRE POSITION AS GENERAL MANAGER OR SALES MANAGER. AGE 42. EMPLOYED. ADDRESS: BOX 669, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

FOUNDRY MANAGER

Present position with Meehanite Metal Corporation as Foundry Consulting Service Engineer. Have B.E. degree, 20 years foundry experience with heavy, medium, and light gray iron. Scrap reduction, lowering production costs, and improving casting quality are main interest. Age 43. Desired location continental U. S. or Canada. Address: Box 643, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MELTING FOREMAN

Two years supervisory experience Electromelt electric furnace. Experienced in cupola and air furnace melting and all types of refractory. Gray iron and malleable background. Address: Box 658, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT

Practical gray iron foundryman, technically trained, broad experience light/heavy castings. General jobbing high production. Well versed costs, metal sand and scrap control. Desire connection with reliable firm wanting results. Address: Box 661, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Positions Wanted

ENGINEER-ASSISTANT SUPERINTENDENT
Graduate engineer, age 28, practical and technical experience in all phases operations and controls gray iron and Meehanite jobbing foundry. Now employed as superintendent. Desire position with management potential with progressive ferrous foundry. Address: Box 619, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER
Practical foundryman nationally known for a job well done. Age 47. Good health. Now employed. Looking for more action ferrous or nonferrous, $15,000 minimum. Address: Box 645, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGICAL ENGINEER
Good educational and practical background in general foundry and metallurgy of gray malleable and ductile iron. Desire opportunity to prove ability in contacting and selling to the foundry trade. Presently employed. Address: Box 608, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ENGINEER
Graduate mechanical engineer, age 31, ten years experience in mechanized gray iron foundry. Experience in plant layout, machine design, and cost estimating. Desires position with better future. Presently employed. Address: Box 640 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
With 35 years' experience operating iron and steel foundries. Desire to make change. Engineering graduate. Address: Box 671, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CHIEF METALLURGIST
Presently employed, desires more challenging position. Educated and experienced in all phases of foundry, specifically melting of gray malleable and ductile irons. Positively quality and cost conscious. Address: Box 609, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRYMAN
Graduate Metallurgist. Ductile and high test alloy irons, pressure work. 25 years operating jobbing and variety foundries, including heaviest work. Address: Box 686, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Representative Available

MANUFACTURERS' REPRESENTATIVE
Established representative with broad metallurgical background desires additional line. Buffalo, N. Y., headquarters. Address: Box 648, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Foundry Consultants

LET US BE YOUR PARTNER

Our experienced modern Econocast® production and sales organization can operate your foundry at maximum effectiveness, improving properties, reducing cost, delivering your own castings of certified quality on schedule and selling excess capacity to selected regular customers under supply contracts. For more information write:

THE FILTERED METALS COMPANY
P.O. BOX 951
OAK RIDGE, TENNESSEE

or call

E. N. HARRISON
Day 2-2535 **Night 5-0621**

HEVERLE & HAY
ENGINEERING—ACCOUNTING
CONSULTANTS TO INDUSTRY
(Since 1907)
COST CONTROL—COST REDUCTION
FOUNDRY METHODS
121 NORTH BROAD STREET
PHILADELPHIA, PA.

Employment Service

FOUNDRY PERSONNEL SPECIALISTS
National Placement and Procurement of
GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS
Confidential Inquiries Invited
From Employers and Qualified Applicants
For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

Engineering Service

SPECIAL SERVICE . . .
You may have a PROBLEM which you have been UNABLE TO RESOLVE with your own organization personnel. A problem that could be QUICKLY SOLVED in a month . . . a week . . . a day . . . BY A WELL-QUALIFIED MAN of experience. We have a man or men with many years of experience in the exact areas with which you are concerned. Representative areas include plant layout, modernization, operation, selection and installation of equipment, technical processes, metallurgy, personnel development, methods, etc. To help you we assign individuals who have 40 or more years of actual experience in specialized fields . . . invaluable know-how, yours to command for as long as you need it. WRITE OR PHONE for detailed information.

WESTOVER SPECIAL SERVICE ASSOCIATES
3110 W. Fond du Lac Ave., Milwaukee 10, Wisconsin, Phone Custer 3-2121

MAGNESIUM PERMANENT MOLDS
Designed and Gated
Address inquiry to:
BOX 626, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

Foundry Consultants

FOUNDRY WELDING CONSULTANTS

Will train or improve your welders to do quality work on ferrous or nonferrous metals. Rewelding cost eliminated. 20 years experience.

GUETTERMANN WELDING & MFG. CO.
635 UNION AVENUE
BELLEVILLE, ILLINOIS
PHONE ADAMS 3-0080

FOUNDRY CONSULTANT-NONFERROUS
Sand casting—permanent mold casting—centrifugal casting—in aluminum—brasses—bronzes—30% leaded bronze—aircraft quality bearings and castings. Address: ED JENKINS 286 PENOBSCOT BLDG., DETROIT 26, MICHIGAN, PHONE: WOODWARD 5-7947.

Foundries Wanted

FOUNDRY-WANTED-EQUIPMENT
STEEL—GRAY IRON
Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.
BOX 630, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRIES WANTED
FERROUS—NONFERROUS
Production — Jobbing — Captive — Nationwide foundry investment organization. Complete foundry without property will be considered. All replies confidential. PRINCIPALS ONLY.
BOX 631, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ALUMINUM FOUNDRY WANTED
Making die or sand castings and located in Indiana or Ohio. Must have going volume of business with reliable customers. Address: Box 634, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Foundries Wanted

IRON FOUNDRY
Within 200 mile radius of Chicago. Buildings and possibly equipment if suitable to our needs. Will consider proposition to buy into going operation needing additional daily tonnage. Write fully in confidence. Principals only. Address: Box 647, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED
We would like to purchase gray iron, malleable or steel foundry. Must have sales from 20 to 50 ton per day. Prefer Ohio location, near or around Cleveland. Will consider others. Equipment and building unimportant as long as good sales volume exists. Address: Box 641 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

Opportunity

FOR LEASE OR PARTNERSHIP
New foundry building, with equipment. Plenty of room for expansion. Will lease or go into partnership with right person. Paul Williams, 5715 East 7th, Tulsa, Okla. Phone TE 5-4212.

Wanted-To-Buy

IF YOU OPERATE
A FURNACE

We will purchase your scrap linings, retorts, conveyors, muffles, racks, etc. Any item made of nickel alloy.

Write, Wire or Call:
WEINSTEIN COMPANY
610 W. 8th STREET
JAMESTOWN, NEW YORK
PHONE: 61-154

WANTED
Used or broken Silicon Carbide Grinding Wheels of any kind or size, regardless of bond. Will pay $35.00 per ton.

UNION MINING COMPANY
2306 FIRST NATIONAL BANK BLDG.
PITTSBURGH 22, PENNSYLVANIA

Wanted-To-Buy

WANTED TO BUY

All grades of SCRAP ALUMINUM

Truckloads or carloads including:
Drosses, spills, risers, etc.

Submit offering in writing to:

SONKEN-GALAMBA CORP.
KANSAS CITY 18, KANSAS

WANTED

1,000# Muller and a Rota-Blast 8' table with 22" minimum clearance table to head.

ALUMINUM PERMANENT MOLD CO.
1054 FRONT AVE. N.W.
GRAND RAPIDS 4, MICHIGAN

INDUCTION MELTING UNIT

WANTED—A HIGH FREQUENCY INDUCTION MELTING UNIT FOR STEEL. NOT LESS THAN 250 K.W. CAPACITY. ADDRESS: BOX 620 FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

MIXER WANTED

Used Simpson Intensive Sand Mixers, State size, condition and lowest cash price for immediate acceptance. Address: Box 629, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

TABOR Power Yoke Type Jar-Squeeze stack molding machine. Quote specs, age, condition and price. Address: Box 681, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For Sale

FOR SALE

OSBORN #559 (AS NEW) Jolt Pin-Lift Molding Machine Sacrifice Price.

INTERNATIONAL JOLT-PIN LIFT (rebuilt) Twin-Cylinder Molding Machine 36" x 36" table. Reasonable

DETROIT ELECTRIC Melting Furnace 1500# Cold Charge 3300# Molten Metal. With Transformer 13,200 Primary and all accessories. Excellent Condition

AMERICAN TUMBLAST 48" x 42" with Skip Loader (no dust collector). Just taken out of production for larger machine. Wonderful buy.

WHITING Balanced-Blast (Automatic) #4 CUPOLA lines to 42" diam. Being replaced by water-cooled cupola. This is a fine cupola at a good price.

MOULDERS FRIEND 50" Brush Complete, w/extra brush — one-way machine. Rebuilt —most reasonable price.

For this and other good equipment contact:

W. O. McMAHON
BOX 5799, HOMEWOOD STATION
BIRMINGHAM 9, ALABAMA
Phones TRemont 1-2088 or 9-6170

FOR SALE

1000 series Reda Gas Furnace. Excellent condition. Will include all new parts necessary for conversion to oil. $2,000 F.O.B. Mankato, Minnesota.

LITTLE GIANT, INC.
126 WEST ROCK STREET
MANKATO, MINNESOTA

FOR SALE
DETROIT ROCKING FURNACE

Type AA with cylindrical shell, 1200 lb. cold or 2600 lb. hot metal, complete with mechanical and electrical equipment, oil filled Kuhlman transformer, 11,000 volts primary, 125 volts secondary, 2800 amperes full load, installation drawings, unused and crated ten years. Ideal for alloy irons, brass or bronze. Price f.o.b. local cars $6,500.00. Address: HOPE ELECTRICAL PRODUCTS CO., 39 LONG AVENUE, HILLSIDE, N. J., ELIZABETH 4-7837.

FOR SALE

3,000 lb Stroman JC Electromelt Furnace. Used, complete, without lining, oil Hauck Burner with extra shell and following items:
One slag buggy, two 4,000 gallon tanks and 277 pieces of brick (as new). $5,000 f.o.b. car or truck. Write or call Security Alloys Company, Inc., 3104-56 W. 49th Place, Chicago 32, Illinois, Prospect 6-8500.

Foundries For Sale

FOUNDRY
FOR LEASE OR SALE

Favorably located near St. Lawrence Seaway Port, in industrial area, Province Quebec, Canada, modern equipment, 3 differently sized, mechanized production lines, 2 cupolas, single shift capacity approximately 30 tons, new dry-enameling division with 2 most modern furnaces, building approximately 50,000 sq. feet and ten acres of adjoining industrial land suitable diversified foundry operations.

BOX 612, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY FOR SALE

Fully equipped now operating gray iron foundry in western New York State for sale. Located near the New York Power Development. Reason for selling, present owners want to retire.

BOX 664, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOR SALE OR LEASE

Gray iron foundry completely equipped and ready to operate. Large building, approximately 25,000 sq. feet, brick construction. Capacity 45 tons per day. On Sante Fe railroad, 200 miles south of Denver in Trinidad, Colorado. Address: Box 621, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY FOR SALE

Gray iron, 5,000 sq. ft., located in Fairfield, Illinois, new. 10 ton capacity, fully equipped. Would sell all or part. Work available, in same town, excellent opportunity. Address: Box 676, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For Sale

FOR SALE

68 Flasks 24" x 42" 8" Cope 10" Drag
4 Flasks 30" x 36" 10" Cope 8" Drag
Above Sterling flasks never used.
Miscellaneous sizes of used flasks and jackets —cheap.

1 Ross Core Oven—natural gas—500° Temp. with controls. Inside dimensions—11'2" wide x 7'4" high x 13' deep.

1 Simplicity Shakeout 6' x 3'

1 Roots Connersville #4 Cupola Pressure Blower with Foxboro air controls

Call or write:

THE OHIO PRODUCTS COMPANY
ORRVILLE OHIO

FOR SALE

One C 3 Shalco Shell Core Machine $850.00
One 6000 lb. iron pot type zinc melt down furnace $600.00

FORT RECOVERY INDUSTRIES, INC.
FORT RECOVERY, OHIO

FOR SALE

1—No. 1½F Simpson Muller with hood.
This muller has only been used 60 days and is like new.
It may be seen at our warehouse.

STOLLER CHEMICAL & FOUNDRY SUPPLY CO.
780 SHOCALOG RD.
AKRON 20, OHIO

FOR SALE

Two Lindberg radiant fired electric furnaces complete with controls 440 V, 50 KW. Address: ALUMINUM MATCH PLATE CORP., 1500 MILITARY ROAD, BUFFALO 17, NEW YORK.

For Sale

FOR SALE

Fisher Furnace, #600 MNP
Reda Reverberatory Furnace Model 1000 CS
Eclipse Reverberatory Furnace Model F2000G
Campbell-Hausfeld 1000 lb Furnaces
Skip Hoist for 9½ Foot Cupola—complete
Mold Conveyor 268' long
Osborn #405 Rollers
Vibrating Screens
International Rollover RES, Size 15"—6"
Milwaukee 163 Jolt Stripper
Champion J8L 12 Pin Lift, Jolt
Osborn 710J, Pin Lift
Osborn 212J, Jolt Squeezers
Osborn 275J, Jolt Squeezers
SPO 114 Jolt Squeezer
International LSJ, Jolt Squeezer
International PJS, Jolt Squeezer
Milwaukee 104 Jolt Squeezers
Champion J8 108 Jolt Squeezer
Arcade 100S Jolt Squeezer
SPO 506 Jolt Rollover, Pin Lift, Draw
SPO 110 Jolt Squeezer
International Rollover 24-10 G, Portable
International Rollover 30 x 8, no jolt
J & J 610 Rollover, portable
International Pin Lifts
Davenport Pin Lifts
Osborn 559 Pin Lifts
International Type R core rollover, hand
Swing Grinders
Royer Sand Preparators
B & P Preparators
Blystone Sand Mixers
American Sand Cutters, Models M, AM, AA
Coleman Core Oven
Grinders, ½ hp to 25 hp
Disc Grinders
Ladles, from 50 to 10,000 lb.
Pouring Devices, 500 lb. to 2000 lb.
Gyratory Riddles
Tramrail & Switches
Air Hoists, 1000 lb. to 10,000 lb.
Overhead chain conveyor #458, track, drives
Blowers—Centrifugal—positive-exhaust
17", 20", 28", 36" Stack Fans
Spencer Turbo Compressor, 3600 CFM @ 24 oz., 40 Hp. Motor
AAF Dust Collector, Type D, Size 14, Dry
AAF Dust Collector, Type N, Size 1½, Wet
AAF Dust Collector, No. 40 Air Mat Dust Arrestor
Spencer Centrifugal Dust Collector, Multiple Vacuum Type, 300 CFM, @ 5" of Hg., Vacuum
Turner & Hawes Dust Collector, Atmospheric Dry Filter Non-Automatic Type, Size 2500
Pangborn Dust Collector, Cloth & Screen Type Size 11,000 CFM

FLASKS
ALUMINUM
SLIP AND POP
SIZES FROM 10" x 10" TO 48" x 48"
JACKETS
ALUMINUM AND IRON
STEEL FLASKS
CORE PLATES
TRANSITE—IRON
MANY OTHER ITEMS IN STOCK
SEND US YOUR INQUIRIES
WE BUY—SELL—TRADE

THE HOMAN MACHINERY CO.
1144 HARRISON AVE. MAIN 1-0339
CINCINNATI 14, OHIO

FOR SALE

1—Used Style 104EOS-Series "2" Demler Core Blowing Machine-serial No. 3779-complete with 30" cylinder, with 10" draw stroke-without horizontal clamp-with roller conveyor equipped table. Has one ton vibratory sand feeding hopper with sand magazine of capacity to blow 150 lb. core. Inside dimensions at blow plate 2⅜" x 36¼" with blow plate 28" x 40". Address: Box 624, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For Sale

SAND BLAST EQUIPMENT
SELL-BUY-TRADE
GUARANTEED MACHINES
TERMS: 3 YEARS TO PAY

$70,000 worth new Pangborn and Wheelabrator parts. Priced 25% less than list.

6' LF-14 Pangborn Table	$2200.00
9' LG-14 Pangborn Table	4500.00
4' LF—Pangborn Table	2500.00
Pangborn 14 GK Barrel	2500.00
Pangborn 8 x 8 Room	1500.00
Pangborn 53 EN2 Hand cabinet	325.00
Pangborn Auto Peening cabinet	1100.00
14 LG5 Pangborn Multi-table 5—5' tables	9000.00
48 x 48 Wheelabrator Tum. w/loader	3500.00
42 x 48 Wheelabrator Tum. w/loader	2750.00
8' Wheelabrator Table Blast	2000.00
6' Wheelabrator Table Room	4800.00
Pressure Tanks, all types	150.00 up
Vapor Blast cabinets	400.00

All types and sizes of Hand Cabinets, Dust Collectors Pressure tanks, Rooms, Horizontal or vertical Tumbling Barrels and additional Sand Blast Equipment too numerous to mention.

DIAMOND SALES, INC.
5654 W. Jefferson
Detroit 9, Michigan
VI-3-6750

FOR SALE

MOTORS—GENERATORS
TRANSFORMERS
Unused—Rebuilt
WORLD'S LARGEST INVENTORY

ELECTRIC EQUIPMENT COMPANY
Phone station Collect GLenwood 3-6783
P. O. Box 51—Rochester 1, New York

FOR SALE

1—46" x 76" Herman 6000# series charging conveyor type rollover and draw machine, complete with all clamps, vibrators, oil reservoirs, etc.

1—40" x 60" Herman heavy duty 15" solid cylinder jarring machine equipped with pattern stool and power lift conveyor.

1—Rollover Conveyor (rear discharge) with 4 auxiliary rolls.

AMERICAN HOIST & DERRICK COMPANY
63 SOUTH ROBERT STREET
ST. PAUL 7, MINNESOTA
Attention: R. M. Hansen

For Sale

FOR SALE

Tabor Jolt Rollover Molding Machine, size of table 30" x 40"	$1100.00
Tabor 10" molding machine	75.00
Tabor 10" Jolt pin stripper	300.00
Climax wire cutter, 3/16"-¼"	125.00
Uniwash dust collector, 5600 CFM, as new, comb. Detroit 10 h.p. motor	450.00
Magnesium deburring booth, 4 stations, 15 h.p. motor blower	750.00
Flasks, 48" x 48", 6" cope, 6" drag	50.00
Flasks, 52" x 48", 12" over 24"	60.00
Pangborn EN2 cabinet	300.00
Pangborn dust collectors, 3000 CFM, 7½ h.p. motor blower	850.00
Air compressor, Schram, 210 cb. ft. 4 cylinder, air cooled, diesel engine	1300.00
Air compressor, Westinghouse, 4 cylinder, 10 h.p.	550.00

M. ELSTEIN
426 GRAND STREET
JERSEY CITY 2, NEW JERSEY

QUALITY USED EQUIPMENT

4 Sand Blenders
B & P Models S-M-L
Royer Jr.
2 Redford Core Blowers-Bench Type
1 Shakeout table 3 x 4
4 Milwaukee Molding Machines Mods 104
1 Herman Rollover Machine
4 Crucible Melting Furnaces
35 Tight steel flasks—several sizes
20 Adams Snap flasks—several sizes
Many other items—Write for Bulletin #46

SOMIL EQIUPMENT & SUPPLY CO.
P.O. BOX #4
SOUTH MILWAUKEE, WIS.
PHONE SO 2-3880

FOR SALE

Robins Floatex Shakeout Unit 5' x 6' 12,000# cap. New 1951

Jeffrey Vibrating Feeder 10' x 12' with 2.5 KW power supply, new 1950

Yale & Towne 3 Ton "Cable King" Hoist with pendant & trolley

Link Belt Steel Apron Conveyor 20' x 24' with Link Belt Speed Reducer & 5 HP TC motor for use under sand bin

MEECH FOUNDRY, INC.
9906 MEECH AVENUE
CLEVELAND 5, OHIO
MICHIGAN 1-5550

For Sale

FOR SALE

1—Dextrex Degreaser with temperature controls, steam pressure regulator, 2 baskets, size 70" x 25" x 12". Purchased 1955, slightly used.

1—Rotary Lift Hoist. Model F5L2, purchased 1955, never used.

1—PRE2 Ingersoll-Rand Air Compressor, 24 x 12½ x 14 stroke, 210 HP, 440 volt synchronous motor complete with exciter, Serial No. 40569-40570.

1—Type #25 Size 8000 CFH DX Surface Combustion Gas Generator purchased new in 1956.

ALBION MALLEABLE IRON COMPANY
ALBION, MICHIGAN

FOR SALE

1—Simpson #0 Muller—Style M (never used).
1—Lancaster Stainless Steel Counter - Current Batch Mixer, Type LW-62.
1—Lancaster Mixer, Model EBG-4.
1—Lancaster Mixer, Model EAG-3.
1—Ingersoll Rand Air Compressor, Type PRE-2. 24" x 16", 100# pressure with 300 HP motor.
3—Link Belt Roto - Louver Rotary Dryers, Models, 207-10; 310-16 and 502-20.

R. GELB & SONS, INC.
U. S. HIGHWAY 22, RAHWAY VALLEY R.R.
UNION, NEW JERSEY

REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

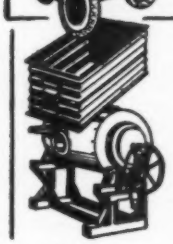
CENTRAL PNEUMATIC SERVICE COMPANY
512 LINDEN AVENUE
DAYTON 3, OHIO

CENTRIFUGAL INDUCTION MELTER

ECCO 16 KVA induction furnace, multi-gap type, complete with linked centrifugal casting machine. Semi-automatic operation. All equipment recently over-hauled. Located Midwest. Asking $1800.00. Address: Box 657, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD — **CLEVELAND 10, OHIO**



WHEELABRATORS
1—20" x 27", 2 cu. ft. Tumblast
1—42" x 48", 17½ cu. ft. Tumblast with loader

MAGNESIUM CLEANING CABINETS
6—90" x 100" x 65" with exhausters, 8000 c.f.m.

MOLDING MACHINES (Automatic)
2—TDA4 Taccones

CORE OVEN
1—Di-Electric, Model CD-25
Coleman, 30 KW.

SWING GRINDERS
10—10 H.P. Mummert-Dixon Model 1814
3—25 H.P. Safety Grinding Wheel Model 204

ELECTRIC FURNACE
1—350 lbs. Detroit Rocking

WANTED!
COMPLETE FOUNDRIES,
SMALL/LARGE.
PROMPT SERVICE.

— **GLENVILLE 1-1222**

AAA MACHINERY & EQUIPMENT CO.

over 1000 satisfied customers

WORLD'S LARGEST INVENTORY OF GUARANTEED FOUNDRY EQUIPMENT

AIR & ELECTRIC HOISTS

85—I & R Air Motor type, sizes LC3, A, B, C, D, D-6 & E, 300, ½, 1, 2, 3 & 5 ton.
15—DETROIT Air Hoists, 1, 1½, 5ton cap.
2—P&H and DETROIT Model LHR, 5 ton.
20—THOR air hoists, ½, 1 & 2 ton cap.

BUCKET ELEVATORS

12—LINK-BELT & JEFFREY, 30, 40, 50, 60 ft. cc, 10 x 7, 12 x 7, 14 x 7, 16 x 8 buckets.

CUT-OFF MACHINES

1—TABOR C10AF, 16" wheel, 10 HP.
3—TESSEMER H & I Sprue Cutters.

CORE BLOWERS

3—CHAMPION Model CB-10, CB-18, & CB-400. From 10 to 300 lb. Cores.
22—DEMMLER Model 1, 1E, 2, 2E, 2K, 3, 3E, 3K, 4 & 4E. 10 to 100 lb. Cores.
1—FEDERAL 40P-1 San-Blo.
7—INTERNATIONAL. Model SB-11 & SB-13, SB-15H, 15 to 30 lb. Cores.
6—OSBORN Nos. 91, 92 192 and 193. From 10 lb. to 75 lb. Cores.
3—MILWAUKEE #3A Bench Type.
2—REDFORD #2—Magazine type.
1—SAN-BLO Model CB-40-B, 40# Cores.
1—SPO Model SC-10-DM. hollow core.

CORE OVENS

1—INDUSTRIAL "Revolving Carriers" continuous, 18" x 90" trays.
1—THERMONIC Model M800A Dielectric. Cap. 900#s per hour.

CUPOLAS, BLOWERS & EQUIP.

1—SPENCER 150 HP 7500 CFM 48 oz.
6—I & R Centrifugal 30, 50, 85 and 100 HP. 3500 to 10,500 CFM w/blast gates.
1—MODERN No. 3½ Cupola.
1—CUPOLA Bondactor. style 1205-L.

ROTO-CLONES WET TYPE

9—AMERICAN AIR FILTER Type N&W, Sizes No. 20, 24, 27, & No. 30, w/sludge ejectors, cap. to 30,000 CFM.

ELECTRIC MELTING FURNACES

4—DETROIT LFA, 350# Cold Charge 700# Molten w/200 KVA transformers.
1—TOCCO 20 KW Induction, 9600 cycles.
3—AJAX No. 100 & 300 Furnaces Only.
1—DETROIT Size CM — 4000# Cold Charge, 8000# Molten, w/1000 KVA trans.
1—AJAX 50KW M.G. Set w/Furnaces—3000 cycle.
2—AJAX 20 KW Hi Frequency Converters.
1—TOCCO 75KW M.G. Set—9600 cycles.

GAS & OIL FIRED FURNACES

23—LINDBERG FISHER Model MNP electric Tilt. Sizes 150, 400, 600, 1000, 1700, 2000 & 2400#, alum. cap. Gas or Oil.
29—LINDBERG & HAUSFELD Stationary, Sizes 100, 150, 200 & 550 cap.
1—LINDBERG #400 BBI hand tilt.
1—LINDBERG #300, ATH, hand tilt.
1—SKLEENAR 1200# Rev., hand tilt.
1—MONARCH 600# Rev., hand tilt.
1—STROMAN, "U" 600# Reverb. Hand Tilt.
1—STROMAN DC "Dipout" 800# cap.
1—ECLIPSE E1000—Double Chamber Dry Hearth 1000# cap.

GRINDERS

Swing Frame

1—MARSCHKE 20" x 10" wheel, 10 HP.
3—MARSCHKE 24" x 3" wheel, 15 HP.
2—U. S. ELEC. Model 24, wheel 24" x 3".
1—MUMMERT-DIXON #2420, wheel 24" x 3".

Snagging

4—FOX #7—30" x 3" Wheel, 15 HP.
2—U. S. #64, 20" x 3", 7½ HP. 4 speed.
2—SAFETY #174, 24" x 3" wheel, 10 HP.
2—MARSCHKE 24" x 4" wheel, 20 HP.
1—U. S. #65, 30" x 3" 15 HP, 4 Speed.
U. S. No. 62VS, 24" wheel, 2-7½ HP motor, variable speed.

Core

2—MILWAUKEE 70-12, 70" dia. table.
1—STONEY Core Grinder, 16" dia. Wheel.

Horizontal Disc

GARDNER No. 124—63" wheel, 20 HP.
GARDNER No. 179, 70" dia. wheel, 40 HP.

LADLES

17—MODERN & WHITING Cylindrical Ladles, 275, 2450, & 3000 lbs. capacity. All Enclosed Gears.
37—MODERN & WHITING Lip Pour, Enclosed Gear, 1200, 1600, 2000, 4000, 6000, 7000, 8000 lbs. capacity.
7—MODERN & WHITING Mixing Ladles, 2 & 3 ton. Electric & Manual Tilting.

NATIONAL ENGINEERING CO.

2-ton sand reclamation system used to reclaim old sand to a new supply. Operated pneumatically with turbine-blower. In use 2 years. Can be inspected. Still installed.

MOLDING MACHINES

Jolt Squeezers

12—OSBORN No. 275-J—17x20 Table, 10"
15—OSBORN No. 276-J—17x26 Table, 13"
2—OSBORN No. 216-PJ—21-32 Table, 16"
6—MILWAUKEE 123—17x26 Table, 12"
2—MILWAUKEE 181—24x36 Table, 18"
10—INT. PVJS—17x26 Table, 12" cyl.

Plain Jolt

1—J&J 50 x 72 Table—5000# cap.
2—OSBORN 60" x 72" table, 6000# cap.
1—TABOR 36" x 36" table, 1000# cap.

Jolt Rollover Pattern Draw

1—DAVENPORT 28A, 25" x 44" table.
1—DAVENPORT 28-SA, 29" x 40" table.
3—HERMAN 1500 lb. Series, 26" x 48".
1—HERMAN 750 lb. Series, 20" x 30".
2—HERMAN 4000 lb. Series, 40" x 60".
14—INTERNATIONAL TYPE G, Sizes 20" x 8", 24" x 10", and 30" x 8".
2—J&J #612, 24" x 30" Table.
4—J&J #918, 44" x 54" Table.
1—J&J #815-B, 30" x 40" Table.
1—MILWAUKEE #167, 32" x 33" Table.
10—OSBORN #40 and 42 Core Rollovers.
1—OSBORN #442, 21" x 31" Table.
2—OSBORN #242W, 29" x 42" Table.
12—OSBORN #601 & 602, 30" & 36" Wide Flask, 10" draw x 750 lbs Cap.
2—OSBORN 643 Table 35" x 50"—2000#.
1—SPO No. 9546—26" x 32" Table.
1—SPO No. 917-A—40" x 29" Table.
1—SPO #413D, 24" x 25" Table.
1—SPO Model 508 table size 28" x 30".
1—SPO 5050, Table 25" x 30", 10" draw
3—TABOR 30" x 40" Table, 12" Draw.
4—TABOR 22" x 42" table, 10" Draw.

Jolt Pin Lift

3—INTERNATIONAL JDP 1600 x 10" draw 36" x 36" Table.
2—J & J No. 688 25" x 30" table, 6" draw.
2—MILWAUKEE No. 1030—30x38 Table.
3—MILWAUKEE No. 3548—44x48 Table.
2—OSBORN #559, 25" x 30" table, 7" draw
1—SPO #3058, 22" x 28" table, 8" draw
2—SPO #3070, Table 26" x 35", 10" draw
1—TABOR, 22" x 32" table.

Pin Lift

2—B & P Model AL 2428 Speed Draw.
1—MILWAUKEE #620 ND Push

Jolt Squeeze Pin Lift

1—MILWAUKEE #125, 21" x 27" Table.
3—MILWAUKEE No. 165, 24" x 30" table.
3—MILWAUKEE #196, 17" x 38" Table.
1—OSBORN #712-V, 18" x 26" Table.
2—OSBORN #710-J, 17" x 21" Table.
9—OSBORN 714PJ, 20" x 31" Tables.
1—OSBORN 716PV, Table 22" x 34", 16" cyl
1—OSBORN #818—24x36 Table, 18" cyl.
1—MILWAUKEE #248—23¼x42 Table, 24" cyl.
4—INTERNATIONAL PKL, 17" x 26".
2—SPO 2114P, Table 21" x 27", 11" cyl.
2—SPO 2160-R, Table 24" x 30", 16" cyl.

Shell Molding

1—SHALCO, Model HO4, 2 station.

CONVEYORS

Steel Apron

9—JEFFREY & LINK-BELT 24", 30", 36", widths. Lengths built to your specifications, with reducers & motors.

Oscillating & Vibrating

1—HEWITT-ROBBINS 24" x 120'—7½ HP.
1—LINK-BELT 48" x 154', 20 HP Motor.
7—JEFFREY TAYLOR No. 5 Vibrating Feeders 24" wide x 7'.
LINK-BELT "FLEXMOUNT"
1—8" W x 50' L x 4" deep pan
1—12" W x 21' L x 4" deep pan
1—12" W x 26' L x 4" deep pan
2—18" W x 13' L x 4" deep pan

Roller

2500' MATHEWS 6", 12" wide, 2⅞" dia. roller, 1¼" hex shaft, 4" channel.
1500—MATHEWS 8" x 12" wide, 3½" dia. 1" hex shaft on 6" centers, 6" channel.

Mold

1—DUO-ROLL 88 Cars 20" x 48", 350' track, with automatic dumping.
1—PALMER "B" 106 Cars—42" x 62" w/550' Track.

Belt

LINK-BELT & JEFFREY 18", 24" & 30" wide. Flat or trough idlers, all Timken bearings. Built to your specifications. Can be equipped with molders hoppers & Ploughs.

HOPPERS & STORAGE BINS

7—NATIONAL & LINK-BELT Storage Bins, 60 to 150 tons cap.
1—NEWAYGO HS-7-GT, Handy Sandy.
42—MOLDERS Hoppers 1½ ton cap.

SAND MULLERS

1—B & P #50 Speedmuller 9 cu. ft. w/loader and air cooling.
1—B&P #30 Speedmuller 4 cu. ft. w/Loader.
1—B & P #60, Speed Muller, 12 cu ft.
2—B & P #70, Speed Mullers, 18 cu ft.
1—BESSER Paddle Type, 30 cu. ft.
1—CINCINNATI 24" muller.
2—CLEARFIELD No. 610 w/skip hoist loaders, 10 to 14 cu ft batch.
1—CLEARFIELD #404, 4 cu. ft. batch.
1—DRAVO-DOYLE 6 cu ft cap, Port.
1—LINK-BELT 48" x 8' Paddle Type.
1—PEKAY No. 160-1-24 Mixer Muller, single stage for 24" belt, 230 TPH.
1—SIMPSON #0, style C, 175 lb.
2—SIMPSON #2, Style C, 1500# w/loader.
3—SIMPSON #3, Style C, 3000 lb.
3—SIMPSON #3, Style UD, 3000 lb.
2—Mixer Muller, 6 cu ft paddle type.
1—LANCASTER No. EDG-4, 5 cu. ft.
1—LANCASTER #EA-4, 6 cu. ft. w/loader.

SAND PREPARATORS

6—B & P Screenerators, Models S, M & L.
8—ROYER Models, NC-4, NDS, NDP.
6—AMERICAN Sand Cutters, Model M, Sizes 79/60, 89/70, 99/80. All late.
4—AMERICAN Model AA and AM, 45" & 60" Cutting Blade.
1—AMERICAN "Sand Master," 102"/70" Cutting Blade—1952.
2—MOULDERS' FRIEND 50" & 60" Brush.
2—NEWAYGO RS-V Reddy Sandys.
1—SIMPLICITY LP 2' x 3' screen.

SANDSLINGERS

1—B & P Motive Jr., 300 cu ft tank.
2—B & P Tractor Type 19" head & 16" head, 13' arms. Magnetic towers.
6—B & P Models DB Stationary Sand Slingers, 16", 19" and 22" heads with 20, 25, 40 and 50 HP motors. All late.
2—B & P Swing Type Slingers 19" head.
4—B & P 5 ton plate feeders.
2—B & P 35 ton capacity plate feeders.
6—B & P Tanks for speed slingers.
1—B&P Motive 15' Jib—6' Ram—19"—25 HP.
1—B&P Motive Jr. 8' Jib—4' Ram—19"—25 HP.

SHAKEOUTS & SCREENS

1—ALLIS-CHALMERS 5' x 8', portable.
2—LINK-BELT 5' x 10', 6 ton cap.
3—SIMPLICITY 4' x 6' Model B.
1—SIMPLICITY 4' x 8' Model D.
1—SIMPLICITY 4' x 10' Model D.
1—SIMPLICITY 5' x 8' Model D.
1—NATIONAL ENG. 5' x 8' Hex Screen.
1—HEWITT-ROBINS 36" x 78" Vibrex.
1—SIMPLICITY 4' x 10' Model B, Single deck sifter screen, 10 HP motors.
2—ROBBINS 3' x 4' JF6—2000#.
2—ROBBINS 3' x 5' JF6—2000#.
1—ROBBINS 6' x 10' JF11—20,000#.

SAND BLAST EQUIPMENT

2—AMERICAN 36" continuous Tumblasts
1—AMERICAN 20" x 27" w/dust collector.
1—AMERICAN 36" x 42", w/skip hoist.
2—AMERICAN 48" x 42", w/skip hoist.
1—AMERICAN 27" x 36", w/skip hoist.
1—AMERICAN 48" x 48", w/skip hoist
1—AMERICAN 48" x 72" w/loader.
1—AMERICAN #3 Tabinst, 4—48" tables.
1—AMERICAN #1 Tabinst 7-14" tables.
1—PANGBORN #45, type MT Sand Blast Room 10' L x 8' W x 6' H.
1—PANGBORN Model 6-LF, 6' diameter plain table with dust collector.
1—PANGBORN 6 LG-14 Multi-Table, 6-24" tables, w/dust collector.
1—PANGBORN Model 14GK-7 Roto-Blast barrel w/loader.
1—PANGBORN 9LG-14 Multi-Table w/6—36" dia. Aux. Tables w/Dust Collector.

AAA MACHINERY & EQUIPMENT CO.

10900 CEDAR ROAD—CLEVELAND 6, OHIO—CALL SW 1-3900

UNIVERSAL REBUILT EQUIPMENT GUARANTEED

AIR COMPRESSORS

COMPLETE STOCK — BURY, PENNSYLVANIA, SULLIVAN, INGERSOLL-RAND —SEND YOUR REQUIREMENTS

BLOWERS

25—CENTRIFUGAL 16 oz., 2 to 5 HP
10—GE, WILBRAHAM - GREEN, FISHER Positive Pressure & Cent. Cupola Blowers

CLEANING EQUIPMENT & TUMBLING BARRELS

1—15" x 20" WHEELABRATOR Tumblast
1—20" x 27" WHEELABRATOR Tumblast
2—27" x 36" WHEELABRATOR Tumblast, one rubber belt, one steel conveyor
1—36" x 42" WHEELABRATOR Tumblast
1—48" x 42" WHEELABRATOR Tumblast,
1—24" WHEELABRATOR Swing Table
1—1-A WHEELABRATOR Multi-table with 6—26" aux. tables, 10—16" aux. tables
1—PANGBORN TAILGAST, 8' Table, 2500 #
1—PANGBORN 6'LK Table Room
1—SLY, 66" x 32" Round
4—SLY 48" x 36" Round

63" x 96" **WHEELABRATOR** Tumblast complete with Dust Collector & Skip Hoist Loader—Used 8 months—LIKE NEW! Inspection under power. PRICED FOR QUICK SALE.

CONVEYORS

1—HEWITT-ROBINS Oscillating, 18" W x 40' L
1—HEWITT-ROBBINS Vibrating, 18" W x 10' L, Model VC-1
1—LINK-BELT, CAR type mold, 114 cars, 403' track, car size 18" x 42"
1—SIMPLICITY, 24" x 10" Feeder w/hopper, Model OA-10-JA2

CORE BLOWERS

10—DEMMLER #1, #2, #2A, #3K, #4E
3—INTERNATIONAL 8B-13
3—OSBORN #91, #192, #91-10
1—RANDALL MODEL "A," Bench Type
1—TACCONE #4D, 10" Draw Stroke Cyl.

CUPOLAS

1—#8 MORRIS w/vertical skip & blower
1—#9 MORRIS—never used
1—SKIP CHARGER for #9 Cupola with scale and buckets
1—WHITING Skip Charger for #5 Cupola
2—#5 WHITING with charger

DUST COLLECTORS

COMPLETE STOCK—both Wet & Bag Type —send us your requirements

FURNACES—DIRECT ARC MELTING

1—250 lb LECTROMELT, Side Charge
1—2000 lb. SWINDELL, 3/60, 800 KVA
1—1½ Ton HEROULT
1—3 Ton LECTROMELT, Door Charge
1—3 Ton SWINDELL Hyd. Top Charge, 3000 KVA Transformer. Latest Type

FURNACES—INDIRECT ARC

1—60 # DETROIT
1—350 # DETROIT LFA
1—750 # DETROIT LFY, Conical Shell, hyd.
1—1000 # DETROIT AA, 300 KVA
1—3000 # Detroit C, 500 KVA

REBUILT & GUARANTEED

BEARDSLEY & PIPER

#70 Speedmuller

15 cu. ft. batch with Cooling and Skip Loader

FURNACES—INDUCTION MELTING

1—35 KVA, AJAX SPARK GAP, High Freq., steel
1—75 KVA AJAX, 2000 # Brass
1—50 KW GECO, Steel

FURNACES—GAS & OIL

1—225 # Gas, hand tilt.
1—400 # FISHER MNP, Gas Fired, Alum.
1—600 # STROMAN, Gas, "U" Type
1—1200 # Brass, MNP, Oil

FURNACES—HEAT TREAT

1—2' x 3' x 6', gas fired, 1800° F.
1—4' x 4' x 10' Gas Fired Annealing
1—9' x 12' Car Type, gas/oil
1—20" x 36" L&N Draw electric
1—10" x 24" x 60" Gas, double end doors
1—12" x 36" x 8" high HAYES "Certain Curtain"
1—7' Rotary G.E.

MOLDING MACHINES

Jolt Rollover Pattern Draw

1—HERMAN 10,000 #, 48" x 109" table
1—HERMAN 6000 #, 42" x 78"
2—HERMAN 7500 #, 40" x 50" tables
1—HERMAN 7500 #, 40" x 60" table
1—HERMAN 3000 #, 30" x 66" table
5—HERMAN 1500 # to 30" x 48" tables
3—HERMAN 750 #, 24" x 30" tables
1—INTERNATIONAL 30" x 12", Type G, 28" x 35" table
2—INTERNATIONAL, 13" x 17" tables
2—J & J #815RB, 30" x 40" table, 1200 #
1—J & J #1020 50" x 60" table, 3000 #
1—OSBORN #602, 36" x 28", 900 #
1—OSBORN #405, 3000 #, flask size 64" x 57", 26" draw
1—SPO #506, 24" x 25" table, 600 #
4—TABOR 40" x 60", 1500 & 3000 # capacity
2—TABOR 30" x 40" w/air clamps, 1000 #
1—TABOR 22" x 42" pattern draw, shockless, portable, 600 #
1—TABOR 20" x 30", w/air clamps, 1000 #
2—TABOR 14" x 16" Rockover, 150 #

Plain Jolt

2—DAVENPORT, table 24" x 27", 1200 #
1—INTERNATIONAL, 3' x 4' table, 12" cylinder

Jolt Pin Lift

1—HERMAN #4317, 22" x 30" table
2—INTERNATIONAL JDP, 1200 x 8", 24" x 26" table, 8" draw, 1200 #, port.
1—J & J #681-C 30" x 25" table, 600 #
1—OSBORN #589, 25" x 30" table, 6" draw, 1200 #
2—SPO #305, 750 lb., 20" x 27" table
1—TABOR 20" x 24" table, 600 #

Jolt Squeeze Pin Lift

2—INTERNATIONAL PKL, 20" x 28" table, 14" sq., 5½" draw
2—INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
1—MILWAUKEE #126, 21" x 27" table, 12" sq., 1200 #, 8" draw
2—MILWAUKEE #163, 15" x 24" table, 11" sq., 1500 #
2—MILWAUKEE #165, 24" x 30" table, 16" squeeze, 1700 #
5—OSBORN #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
2—SPO #2114P, 21" x 27" table, 600 #
2—SPO #2116, 21" x 27" table, 11" sq., 6" draw

Jolt Squeezers

2—INTERNATIONAL #12 LJS, 16" x 20" table
4—INTERNATIONAL #18 LJS, 16" x 20"
1—NICHOLS #12 F-P, portable, 600 #
2—OSBORN #276J, 17" x 26" table, 13" squeeze, 500 # port.
12—SPO #110J, 17" x 20" table port.
1—SPO #113 J, 18½" x 26" table, 13" cyl., port.

MATERIALS HANDLING

1—BYERS, Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
1—HOUGH PAYLOADER, Model HA, 1000 # cap., hyd. lift, mech. dump

MULLERS AND MIXERS

1—B & P #70 Speedmuller, 15 cu ft batch with cooling and skip loader
1—B & P, Conventional, SIMPSON type, 87½" Dia. arranged for cooling
1—CLEARFIELD #404, 4' Dia, 4 cu ft batch
1—CLEARFIELD #610, 6' Dia., 10-14 cu ft batch
1—SIMPSON #0, U.D. 3' Dia., never used
1—SIMPSON #1, U.D., 4' dia., 4 cu. ft. batch
1—SIMPSON #2, 6' U.D. Dia, 14 cu ft batch
1—SIMPSON #3, 8' Dia. Open Gear, 20-25 cu ft batch

LADLES AND POURING DEVICES

Bottom Pour

4—MODERN, 49" x 49"
2—MODERN Crane Type, 55" H x 50" top
1—MODERN Crane Type, 60" H x 60" top

Lip Pour

1—WHITING 40" x 40" top dia. geared

Cylindrical

8—WHITING, 26" L x 25" dia, 1100 # iron
7—WHITING, 19" L x 22" dia, 600 # iron
3—WHITING, 38" L x 28" dia, 2200 # iron

Pouring Devices

11—WHITING, 650 # to 2000 # gross cap.

OVENS

1—COLEMAN Oil, 1 compartment, 14'6" L x 80" H x 5' W
1—COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22" x 12' x 10'
1—GENRICH, Elec., 3 drawer, preheating, auto-control, 9' H x 8' W x 6'7" L
1—GENRICH, Electric, Rack Type, 7' W x 7' H x 5'3" L
3—GENRICH Gas, elevator type, Inspection under operation in N.Y.C.—Excellent Condition
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2—ROSS, Gas, 2 compartment, recirc., rack type, 6¼' x 14' x 7'

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1—B & P Nite-Gang
2—B & P Screenarator, Model "S" & "M"
1—LINK-BELT Revivifier
2—ROYER, NC-2, 10-15 tons/hr, 1½ HP
1—ROYER PREPARATOR, Comb. Model NDC, 25 ton/hr scrap removal, 8' x 8' hopper
3—ROYERS, NDP, 15-25 tons/hr, 2 Hp

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1—B&P Stationary, Single Speed
2—B&P Tractor Type, 16" head
2—B&P Tractor Type, 19" head
1—SIMPLICITY Type SOBG, 4' x 5' screen

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1—500,000 lb. TINIUS OLSEN Hydraulic Compression Testing Machine
BRINNEL Hardness Testers, Manual & Motorized

MISCELLANEOUS

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INTERNATIONAL SB 13, up to 60# cores
INTERNATIONAL SB 12, medium sized cores
INTERNATIONAL SB 11, medium sized cores
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OSBORN 2035-2 large sized cores

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5—MILWAUKEE 70-9 & 70-12s
1—OWOSSO DE1-303 42" table

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4000# Industrial, Insulated

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3—#165-6B MILWAUKEE table, 24" x 30"
2—OSBORN 712 PJ 18" x 28" table
1—CHAMPION JSL10P 18" x 21" table 6" draw
2—#2114G SPO table, 20" x 27"-11" cyl.
2—OSBORN 712 PV
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4—CHAMPION, JS10P 18" x 21" table
2—OSBORN 275PJ
2—MILWAUKEE 244 Jolt Squeeze car type head
MILWAUKEE 181-7, 24" x 36" table

JOLT ROLLOVER DRAWS
2—750# HERMAN 20" x 30" table
1—INTERNATIONAL RJ 20" x 12"
3—SPO 9032

JOLT PIN LIFTS
2—INTERNATIONAL 1200-S 26" x 27" table, 8" draw

PIN LIFT PUSHOFF
MILWAUKEE 620ND 20" x 24" table

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1—#1 Simpson Muller
B & P #30 w/skip loader; multrol heating, cooling blower.

SAND CUTTERS
1—ROYER MCZ-43

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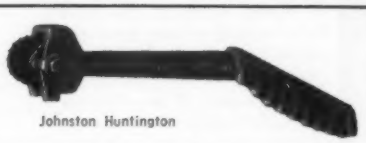

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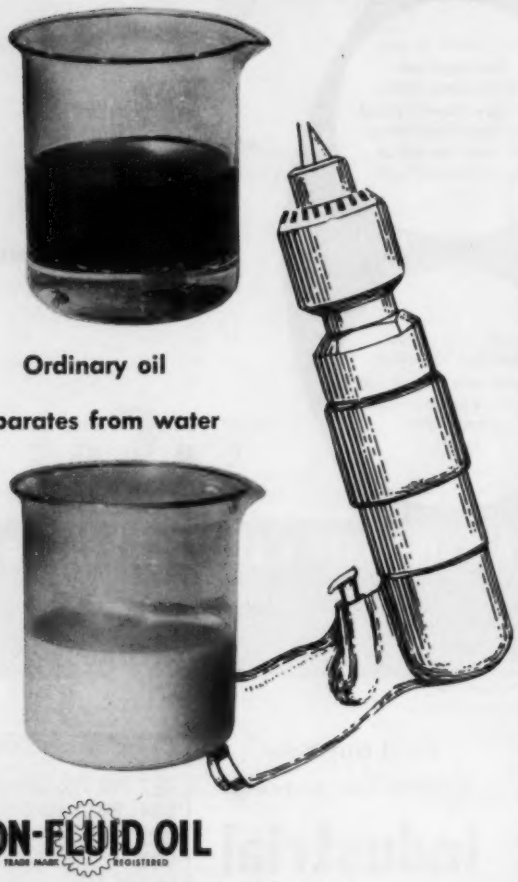

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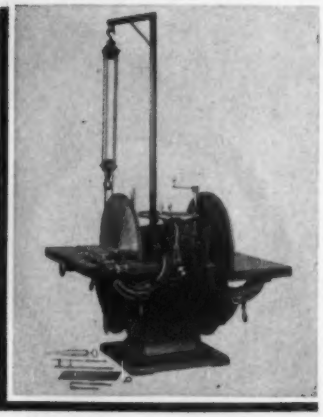

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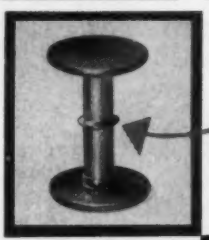

it's the fin that stops leakage

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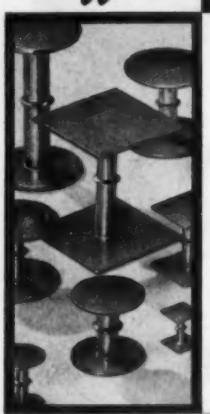

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PSC Sheet Alloy Radiant Tubes COST LESS • LAST LONGER

Let Us Demonstrate This

If you are using cast alloy tubes, we can quote you substantially less on our all-sheet alloy tubes. And, with dies on hand for many commonly used sizes of return bends, we can frequently save our customers this important cost. Records of scores of installations show PSC "Thin Wall" tubes are giving much longer service life. For instance, Michigan Malleable Iron Co. reports: "We show an average life of over 3½ years for your fabricated tubes, which is about double our experience with cast alloy tubes". In PSC tubes the return bends are of the same metal and thickness as the legs, promoting uniform flow of gas and minimizing carbon build-up and consequent burn-out. Precision-assembled in any design or dimension. Also sheet-alloy heat-treating retorts and covers, boxes, baskets, fixtures, tubes, etc. We invite your inquiries.

Save with PSC All-Sheet Equipment

THE PRESSED STEEL CO. • Wilkes-Barre, Pa.

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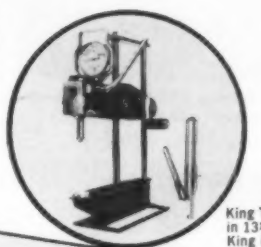
MAKE ALL BRINELL HARDNESS TESTS WITH

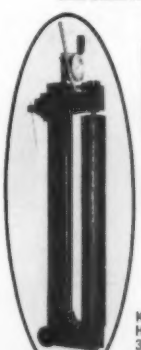
The KING PORTABLE TESTER

King Test Head with Chain Adapter

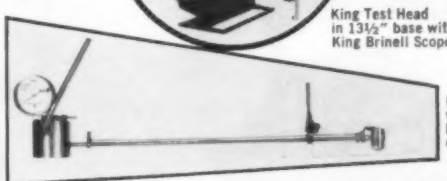


King Test Head in 13½" base with King Brinell Scope

ONE TEST HEAD FITS MANY INEXPENSIVE ADAPTERS



King Test Head in 30" base



King Bore Brinell with small test head for pipes, cylinders, etc.

The KING PORTABLE HARDNESS TESTER

- To test any size, shape or thickness of metal.
- Makes guaranteed accurate on-the-spot tests — anywhere!
- Gap 10" — 13½" — 30". Throat 4" — 6¾" or larger with chain adapter.
- Loads from 62½ Kg. to full 3000 Kg. 5mm or 10mm steel or carbide ball.
- Will make tests in places no other tester can reach — including cylinder bores.

Write for literature and prices to Dept. F959

KING TESTER CORPORATION 440 N. 13th St., Phila. 23, Pa.
Known the world over for accuracy and dependability

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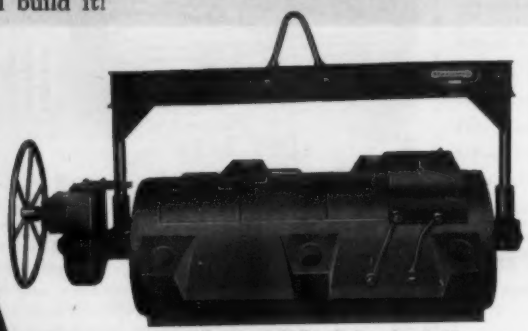
LADLES UNLIMITED

Wherever metal is treated, inoculated, distributed or poured — MECHANICALLY — the chances are good that the ladle equipment is MODERN! Ladles in all types and sizes are engineered to the metal loads and pouring conditions. There are no size limitations: You name it! We'll build it!

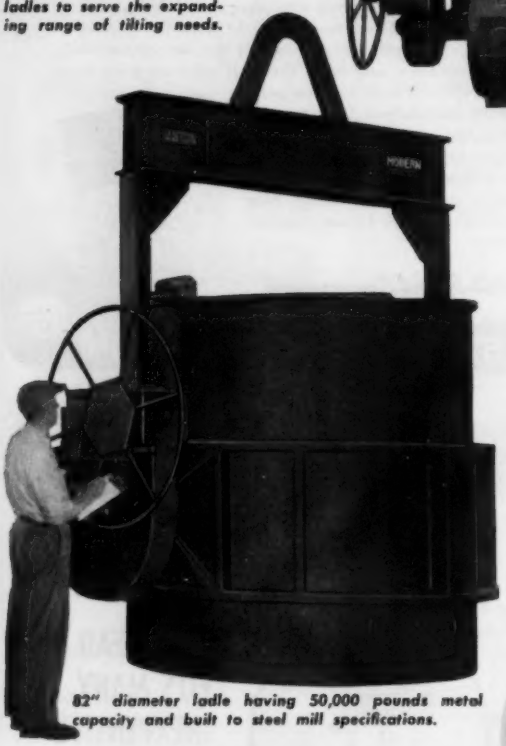
800 pound, straight-sided ladle with square bail and gearing. Seven standard gear sizes are available for ladles to serve the expanding range of tilting needs.

Modern 17½" top diameter, tapered, covered ladle with No. 1 type shank, roller bearing trunnions and detachable bail.

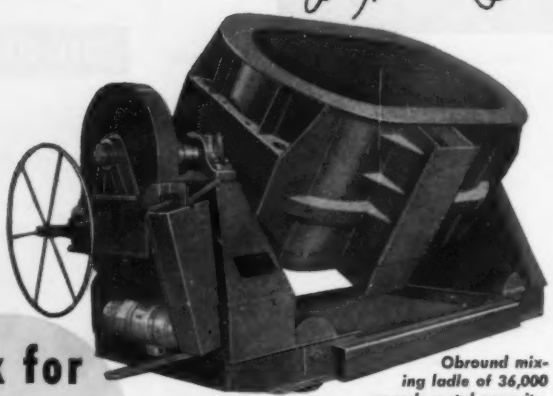


A five-spout ladle, designed to hold 1500 pounds, pours from either side.

Pete—
I believe we should order a couple new ladles now! See me!
B.K.

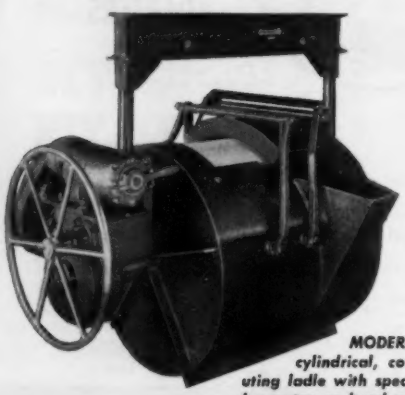


82" diameter ladle having 50,000 pounds metal capacity and built to steel mill specifications.



Obround mixing ladle of 36,000 pounds metal capacity.

Ask for CATALOG P-152-A



MODERN 2000 pound cylindrical, covered, distributing ladle with special bail. Tilted by motor or hand wheel.

Special inoculation ladle on transfer car. Ladle bowl is detachable.

MODERN EQUIPMENT COMPANY
PORT WASHINGTON, WISCONSIN

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STEVENS LIQUID PARTING

Thirty, forty, sometimes even more molds from one application! That's why Stevens Liquid Parting is the world's best seller.

For the cleanest molds — and the most molds per application — switch to Stevens Liquid Parting now. Contact your local Stevens sales representative. He'll give you the complete story.

STEVENS LIQUID PARTING, WORLD'S BEST SELLER
because . . .

1. It's the fastest, most economical mold preparation.
2. It assures the finest detail in finished castings.
3. It saves up to 200% in parting materials.
4. There is no waste — no dust.

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DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
INDIANAPOLIS MILWAUKEE NEW HAVEN SPRINGFIELD (OHIO

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EVERYTHING FOR A FOUNDRY

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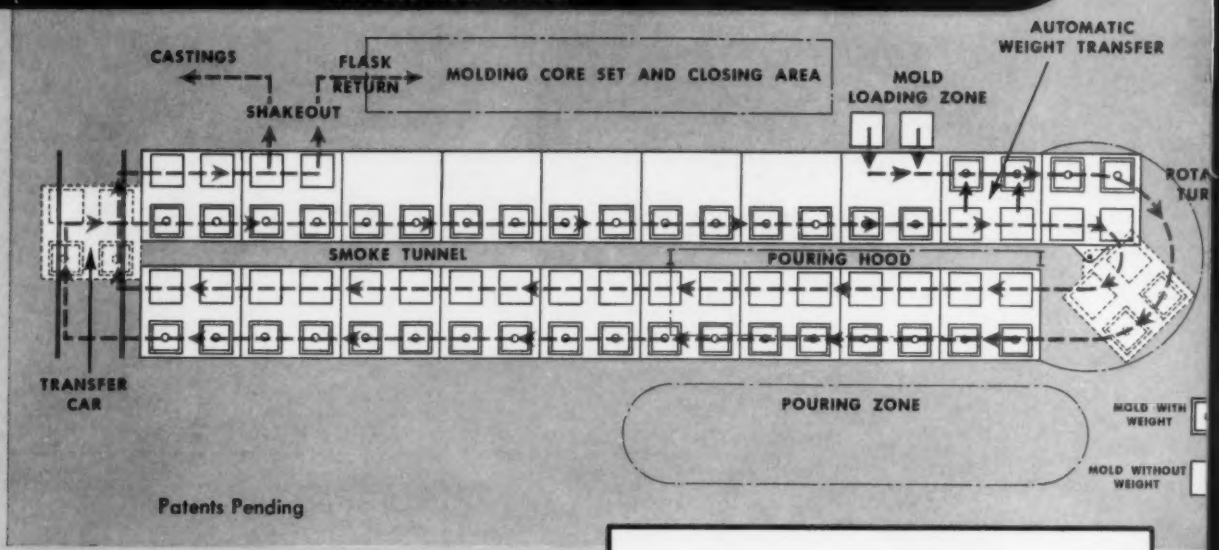
Another NEW BARTLETT-SNOW CLEVELAND 5, OHIO development

Double "MI" MOLDING SYSTEM

(INDEXING TYPE)



Inexpensive, rugged, high capacity system increases production; provides more cooling per square foot of floor space than conventional mold conveyors.

OPERATION

The RED ARROWS in the above diagram show the unique path of the molds through weight transfer, pouring, cooling and to shakeout.

ADVANTAGES

1 Molding machines are located outside the loop for greater accessibility for pattern changes and easy delivery of cores to core set area.

2 Since shakeout, or punchout, is outside the loop, the handling of castings is easier and less costly, and flask return is simplified.

3 Layout is extremely compact. No wasted floor area inside the loop. A minimum of foundations and pits are required.

4 The mold cars can be of any size. The system can be adapted to handle any size of mold — with any metal poured.

5 Loading, discharging, pouring and weight transfer are accomplished while the cars are stationary.

6 The system operates hydraulically with controlled acceleration and deceleration — on any indexing cycle to meet molding machine capacity and any required castings cooling period.

● For more information about this new system, and other cost reducing ideas for your foundry, call your nearest Bartlett-Snow representative.

THE C. O. BARTLETT & SNOW COMPANY

Designers, Engineers, Fabricators and Erectors of Foundry Equipment

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